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AVIATION AND COSMONAUTICS

No 6, JUNE 1986

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9 OCTOBER 1986

USSR REPORT  
MILITARY AFFAIRS

AVIATION AND COSMONAUTICS

No 6, JUNE 1986

Except where indicated otherwise in the table of contents the following is a complete translation of the Russian-language monthly journal AVIATSIYA I KOSMONAVTIKA published in Moscow.

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## GENERAL KOROLKOV URGES GREATER HEED TO FLIGHT SAFETY

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 6, Jun 86 (signed to press 5 Jun 86) pp 1-3

[Article by Col Gen Avn B. Korolkov, first deputy commander in chief of the Air Force, delegate to the 27th CPSU Congress: "Analysis, Conclusion, Result"]

[Text] A high level of political and labor enthusiasm, evoked by the historic decisions of the 27th CPSU Congress, is currently being observed in the combined units and units of the Air Force. Air Force personnel are endeavoring to respond by deeds, by specific results in their military labor, to the demands of the Communist Party of the Soviet Union pertaining to further increasing the combat readiness of our country's Armed Forces. Air Force personnel are improving their level of knowledge, their flying and job-related skills in training activities and tactical air exercises. Both the tasks assigned to military personnel and the ways to accomplish them are complex and require a serious attitude.

Increase in the job proficiency of aviation personnel and maintaining the combat readiness of subunits and units at the requisite level are inconceivable without unswerving observance of the laws governing flying service and the requirements of the documents governing flight operations and flight safety. It is a task of national importance to achieve high results in combat training and at the same time to reduce air mishaps and mishap-threatening situations to a minimum. All aviation personnel are called upon to accomplish this task.

As experience indicates, one way to proceed in this matter is a thorough analysis of facts and phenomena, a comprehensive and content-rich conclusion fostering a radical improvement in the activities of all persons in authority directly or indirectly involved in flight operations and flight operations support. Precisely for this reason guideline documents demand thorough study and comprehensive understanding of what is taking place and a high degree of competence in evaluations and judgments. This approach to resolving this important problem makes it possible to avoid erroneous conclusions which harbor a danger, especially in those instances involving the causes of near-mishap situations and air mishaps.

Combat training activities naturally involve considerable expenditures of time and energy. Practical experience has shown, however, that these expenditures are fully recouped if rigorous methodological consistency, plan and schedule discipline are observed in the training process, and if an atmosphere of strong organization, mutual demandingness and responsibility is created in the collectives. As a rule this results in fewer mistakes, which also has a beneficent effect on combat readiness.

Nevertheless, in spite of the considerable work done in the units by command authorities, staffs and political agencies, party and Komsomol organizations to prevent errors on the part of aircrews, engineers and technician personnel, deviations from the requirements are continuing. Why is this? It is not easy to give an unequivocal reply to this question. There are many factors involved. It is a cause for concern that certain command personnel attempt to justify mistakes in job-related activities with the statement that anybody can make a mistake. I am deeply convinced that this is merely an excuse, concealing an attitude of irresponsibility. There should be no place in aviation for chance occurrence. This should be borne in mind both by the lowliest mechanic and the loftiest general. Can we tolerate a situation where people are governed by chance, and as a consequence to boot of the ignorance, lack of discipline, or lack of initiative on the part of certain individuals?

I shall cite an example. Military Pilot 1st Class Capt A. Kutuzov made an error while flying to the practice area in a two-seater with instructor pilot Military Pilot-Expert Marksman Lt Col N. Anfinogenov: he cut off his afterburner at the wrong time during execution of a wingover. On the descending segment of this maneuver, the pilot pulled back hard on the controls. This coincided with the moment he cut off the afterburner, which resulted in the aircraft entering a stall....

It was ascertained in the course of the ensuing inquiry that instructor pilot Lieutenant Colonel Anfinogenov had taken off unprepared. This naturally had an effect on his actions in the air: he was unable to correct the error in a prompt manner. The instructor was permitted to teach advanced maneuvers without a thorough testing of his level of preparedness. But what about Anfinogenov himself? He surely was aware of the gaps in his knowledge and skills. Why did he not forthrightly admit this to his commanding officer? Evidently this officer was governed by a feeling of false embarrassment, excessive self-confidence and irresponsibility. These qualities are alien to aviators. They must be ruthlessly combated and eliminated at all costs.

It is noted in the Political Report to the 27th CPSU Congress that any reorganization of the mechanism of economic management begins with reorganization of consciousness, a clear understanding of the new tasks, and rejection of past established stereotypes of thinking and action. But it is hard to comprehend those who simply sit around waiting or, like a Gogol character scheming about all sorts of projects, do and change practically nothing. Persons of this type can have no foresight.

This statement is correct! It means that each and every leader and commander, regardless of position held, must closely scrutinize his work style, from a

neutral vantage point, so to speak, and ask the question: Is everything being done in this outfit in order successfully to accomplish its assigned tasks?

It has long been a known fact that he who devotes adequate time and effort to teaching his subordinates, who takes the experience and know-how of others into account, and who is continuously learning himself, makes far fewer mistakes and, in particular, repeats them far less frequently. On the other hand, the quantity and danger of mistakes increase wherever there is failure to penetrate deep into the substance of causes of violations of flight rules and regulations, wherever carelessness, negligence, and excessive attention to form with consequent detriment to content occur in one's work, and wherever people close their eyes to so-called "trivial matters."

Practical experience has proven that various deviations which in the final analysis lead to mishap-threatening situations begin precisely with small items.

Since there is a certain probability of occurrence of given errors, the following question inevitably arises: how can they be prevented? On the one hand, there is a simple answer: one must unswervingly observe the requirements of guideline documents. This is true. Organization of flight activities, training methods, and safety measures are spelled out in detail. As practical experience shows, however, the difficulty lies in the fact that existing rules and regulations must be carried out not in a lip-service manner but consciously, knowledgeably, even innovatively, I would say. Judging by all indications, it is more difficult to achieve this approach to things, and primarily because not all command personnel teach their subordinates to have a conscientious attitude toward their job-related duties. This is displayed in particular contrast at postflight debriefing and analysis sessions. Here is an example.

A young pilot committed a gross error when executing advanced maneuvers in the practice area. It was established in the course of determining the causes that this officer had on previous occasions also allowed his airspeed to drop off dangerously at the top of vertical maneuvers. This was eloquently indicated by the flight data recorder tapes. It is reasonable to assume that the flight and squadron commanders should have picked up this error. But nobody did. In addition, post-flight critique and analysis was done in a superficial manner in this subunit, without detailed analysis. An atmosphere of undemandingness and passivity was created in this collective as a result. Hence personnel were making mistakes in their flying procedures.

The squadron commander replied to the question why training in the subunit was not being properly handled that there was not enough time available. To put it bluntly, reference to how busy they are is rather weak justification in this instance, since what they have ignored is not something of secondary importance but essentially one of the main, key items -- professional training and flight safety. A large part of training time is devoted precisely to this. And it is a matter of commander honor, duty and obligation to improve organization of the training process, work methods and style of leadership.



It was noted at the 27th CPSU Congress: "It is not enough to see and castigate deficiencies and weak points; everything must be done to eliminate them."

I am deeply convinced that a guarantee of prevention of errors and air mishap-threatening situations forms the basis of flying methods proficiency, the organizing abilities and responsibility of leader personnel as well as the professional expertise of the pilots.

Naturally not all causes of errors lie on the surface. It is necessary to work hard to reveal some causes, meticulously examining massive quantities of factual material. Unfortunately haste and a superficial approach frequently occur in such instances, which is fraught with serious consequences. In other words, that for which an analysis is being conducted is what falls victim.

There is no doubt of the fact that flight data recorder tapes are a reliable assistant to aviation commanders in the training process. Conscientious study of these tapes enables one to penetrate fairly deeply into the substance of errors, to understand their causes, and to determine methods of correction. Flight recorder tapes enable instructor pilots even to detect errors which are not immediately noted during the execution of complex maneuver sequences or special task assignments. Thanks to this, in preparing for the next training sortie a commander and his subordinate can devote greater attention to correcting specific deficiencies, can avoid predictable routine in training, and can utilize each and every minute of training time with maximum benefit.

We should note that some commanders continue to work in the old way, utilizing excessively simplified methods of analysis of their men's performance, analyzing by eye, so to speak. Frequently flight recorder tapes are examined only in order to determine whether flight parameters (essentially airspeed, altitude, G forces) exceed limits. And yet it is obvious to everybody that factors which under certain conditions can lead to undesirable consequences may lie concealed within these parameter limits.

No less crucial is the matter of verification that leader personnel are prepared for flight operations. At first glance it would seem quite simple: chain of command also presumes a system of verification. It turns out in actual fact, however, that while the flight readiness, for example, of aircraft commanders and flight commanders is regularly checked by the squadron commander and his deputies, they themselves, as well as the regimental commanders and their deputies, are frequently not checked. Who will check the regimental commander, for example? According to regulations, this is to be done by persons from higher headquarters. But they do this rarely, claiming that they are too busy. Inspectors from higher-echelon agencies also are not very anxious to go up with union commanders, feeling "shy" about making adverse comments in order not to do harm to friendly relations. This practice must be given up. The matter is quite unequivocal: nobody involved in flight operations should go untested and unchecked. An aircraft recognizes no authority than one -- competent handling. Here is confirmation of this.

Military Pilot 1st Class Lt Col N. Rozhkov, apparently believing in his own infallibility, had done a poor job of preparing for flight operations. When he was aloft, executing a vertical maneuver together with another aircraft, he

failed to check operation of his leading-edge flaps at high angles of attack. At a climb angle of 35 degrees, the pilot noticed that his aircraft was continuing to pitch up slightly. His wingman, seeing that the leader's leading-edge flaps had failed to extend, radioed a warning. The flight leader, however, reaching this conclusion on the basis of his instruments and endeavoring to put his combat jet into level flight with a half-roll, continued rearward pressure on the controls and overrode the automatic angle-of-attack limiter. As a result the aircraft spontaneously proceeded to increase the dive angle and to turn on the aircraft's roll axis. It turns out that the pilot had failed to switch on the lift-augmentation system. This was a glaring case of pilot error.

Commanders and flight operations officers sometimes approach in a superficial manner the matter of determining various causes of errors. During flight operations shifts some merely note down the fact of mistakes and errors of omission by their subordinates. They say that things are more apparent to the flight operations officer, since he keeps an eye on everything taking place on the airfield and in the air. But is this always true? After all, even if a mistake is made right in front of one's very eyes, this does not mean that one can immediately draw the correct conclusions. Such "promptness" in assessing the actions of subordinates occurs frequently, however. It is appropriate at this point to say once more that excessive haste subsequently becomes a serious hindrance to determination of the truth.

Errors during takeoff, approach and landing, for example, are frequently assumed to be a consequence of carelessness on the part of the pilot. But if the tower controller suggested how to correct the error and the pilot failed to do so, this would be interpreted as failure to carry out instructions. And supporting arguments are brought forth immediately: yesterday the officer had performed takeoff and landings with no problems, but today he had made a mistake. With a more detailed examination it is ascertained that we are dealing not at all with a chance pilot error but with the fact that alertness of monitoring had diminished, with consequent failure promptly to spot the symptoms of a future error.

A flight operations officer unquestionably enjoys a great deal of authority and respect. Flight personnel should accept his decisions without question. As regards errors made by subordinates, it is the immediate superiors who are primarily responsible for determining their cause, examining every detail of assignment execution, subsequently scheduling and conducting training classes and drills, and noting this fact down in the flight operations officer's log.

Thorough analysis of combined data makes it possible promptly to detect any, even the most insignificant error in flying technique, weapons delivery, and to catch any tendency toward repetition of errors. Thus, when done promptly, one can take specific measures to prevent more serious errors. And, as we know, prevention is the most effective weapon in the campaign for accident-free flying.

I feel that the following important detail should be noted at this point. When concerned with prevention, one should not limit one's attention solely to one's own unit or subunit. But this happens.

A pilot aborted takeoff because his afterburner failed to cut in. The aircraft technician, who had failed to open an oxygen valve, was determined to be responsible. The same thing had occurred somewhat previously in a neighboring unit. It did not arouse particular concern, however, on the part of the commanding officer and his deputy commander for aviation engineer service until the same thing happened here.

This once again confirms the statement that in preventive efforts one must vigorously adhere to the following principle: from substantive analysis to specific practical activity to foresight. This is precisely the procedure followed by Military Pilot 1st Class officer A. Perevalov. He approaches the study of all information and data in an innovative manner, correctly maintaining that to-the-point lessons from mistakes and deficiencies are the best way to avoid their repetition. Therefore, when thoroughly examining a problem which has occurred, Perevalov critically appraises his own performance. He teaches his men to utilize statistics skillfully in preparing for a training activity, to select analogous or similar incidents from their own practical experience or documentary sources, to evaluate the effectiveness of adopted measures and recommendations, and to find illustrative or theoretical materials. He then draws up a training class plan and schedule for his flight personnel. This commander endeavors to ensure that training is accompanied by adequate clarity, avoiding routine pattern, and arousing flight personnel's interest in the items under discussion.

In this unit all deficiencies revealed in the course of preparing for and conducting flight operations are carefully considered. For example, the flight operations officer's log is truly a working document, to which regimental leader personnel and aviation specialist personnel of all categories refer. Thanks to the commanding officer's demandingness and purposeful assistance by the party organization, a combined approach to analysis and study of various errors of omission has become a firm practice in this outfit.

This is producing results. Once one of the pilots, performing a training mission in accustomed conditions, deviated from the prescribed mission parameters. After talking with his subordinates, the squadron commander was inclined to assume that the error had occurred because the pilot had incorrectly distributed his attention. On the basis of this conclusion, he should have conducted a supplementary practice drill in the aircraft cockpit, thoroughly rehearsing equipment procedures in conformity with the subsequent training mission. At first glance this would seem to be quite correct. But then the regimental commander, analyzing the incident, made a substantial correction: it turned out that the pilot had reported to the field that day upset over a domestic problem. It was precisely for this reason that he was unable to concentrate his attention adequately. Of course the officer had acted rashly in concealing his emotional state. This also indicates, however, that it is very important for leader personnel to have a sensitive attitude toward their men.

A careful, alert approach is particularly essential in those situations where an error or near-mishap situation can generate conflicting conclusions. A

broad range of specialist personnel should be enlisted to take part in analyzing such errors, since this helps in amassing professional knowledge and skills in working in one's areas of specialization and penetrating more deeply into the substance of a matter, which is extremely important for development of foresight and for taking measures to prevent accidents in flight operations.

When discussing the prevention of air mishaps, one must focus particular attention on flight operations discipline, the essence of which consists in precise and unswerving observance of the rules and regulations specified by the appropriate documents. These documents, figuratively speaking, are written in the blood of past generations, and any deviation from their requirements contains a danger to the lives of crew members and other personnel in the vicinity. And it is absolutely intolerable when flight rules and regulations are violated by command personnel, whose job it is to keep close watch to ensure their observance. Upon seeing such a thing, subordinates sometimes also take liberties. No wonder there is a popular saying that a bad example is infectious. I recall the following incident in connection with this.

Lt Col A. Rudenko was up with a young pilot in a two-seater. As they were on their landing approach, the squadron commander decided to test the student's alertness and switched on the emergency wheel braking system. The pilot failed to notice what had happened, and the instructor also forgot about it. When they touched down the tires blew, and the aircraft veered off the runway.

One might ask what is the purpose of such a spontaneous move? Particularly since it had not been scheduled and had not been rehearsed on the ground. In addition to damage to the aircraft, the commander's error caused moral damage as well. The squadron commander, who had always demanded strict observance of flight rules and regulations of his men, by committing an unpardonable act of carelessness had virtually nullified his own efforts to instill in aviation personnel a strict attitude toward the job at hand.

Analysis -- conclusion -- result. Each link in this chain is important in its own way, and on the whole this means that work aimed at further increasing combat readiness and flight safety must be performed in a combined and comprehensive manner. The flying profession is one of those types of human activity which involve strict observance of safety regulations. It is particularly important to remember this when in the process of mastering new aircraft and weapons which require that the persons who operate and maintain them alter many of their settled notions and habits and that they acquire new knowledge and skills, as well as the elaboration of specific measures guaranteeing success. As was noted at the 27th CPSU Congress, one must be able to meet today's demands. This is the duty of all Air Force personnel.

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## USING VIDEO EQUIPMENT, COMPUTERS IN AIRCREW TRAINING PROCESS

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 6, Jun 86 (signed to press 5 Jun 86) pp 4-5

[Article, published under the heading "Be Alert, In a Continuous State of Combat Readiness," by Military Pilot 1st Class Maj Gen Avn S. Kalenskiy: "Effectiveness of Combat Training: Problems and Solutions"]

[Text] Adoption of scientific and technological advances into all sectors of our country's economy and development of the productive activeness of the masses is one of the most important strategic tasks and a pressing demand of the times. The importance of this problem is stressed in the Party Program, and ways to accomplish the task are specified in the decisions of the 27th CPSU Congress. Implementing the party's demands calling for acceleration of scientific and technological advance and further strengthening of this country's defense capability, Soviet Air Force personnel are learning to utilize modern aircraft efficiently and are innovatively accomplishing their assigned tasks.

An important condition for achieving a high level of aircrew job proficiency is constant improvement of the combat training process on the basis of utilization of modern scientific and technological advances. We must state, however, that the new approach to the process of learning is having difficulty in gaining acceptance. Lagging behind requirements is leading to a decrease in the combat potential of subunits, to unwarranted expenditure of resources, and to an increased probability of faulty aircrew actions. How can this problem be solved?

As we know, the level of organization of combat training depends to a considerable degree on what technical means are utilized in planning and running flight operations shifts as well as in analyzing the quality of accomplished flight assignments. This relationship is dictated by the fact that the volume of information processed by Air Force command personnel in the course of carrying out combat training missions has increased considerably. There has also been an increase in the volume of work performed by aircrews in the process of preparing for flight operations. In these conditions it is becoming increasingly more difficult correctly to organize flight training without the extensive use of computers.

Advances in cybernetics and electronics are applied not only in modern aircraft but also in cockpit simulators, training displays, automated flight information processing systems, at headquarters, command posts, and in control towers. Practical experience indicates that computer capabilities are unfortunately not yet being sufficiently fully utilized.

Modern simulator systems based on digital computers possess considerable additional potential. Well-planned practice sessions help fully prepare for a training sortie. The simulator makes it possible to simulate flight conditions and consequently enables combat pilots to display initiative and innovativeness, and correctly to reach a well-reasoned decision in an emergency situation. Research in the field of engineering psychology indicates that the ability quickly to make an intelligent decision in a complex situation can be learned. The expediency of this is confirmed by statistics on flying mishaps in civil aviation.

According to ICAO figures, the greatest number of aircraft accidents during landing have taken place due to incompetent evaluation of actual conditions by the pilot in command and making an unwarranted decision to land, as well as faulty correction of errors and lack of coordination among crew members. Therefore flight simulators should be used not only to develop skills in flying technique and weapons delivery but, chiefly, for flight personnel to drill in emergency procedures when landing at weather minimums, employment of effective tactics, responding to aircraft equipment malfunctions, etc. But this requires thorough elaboration of a set of problems which the pilot is to resolve in the cockpit simulator. In other words practical simulator training sessions must be properly planned and supervised.

Purposeful utilization of flight simulators makes it possible to avoid excessive standardization of pilot thinking and helps develop innovativeness and initiative. Nor should one forget that a simulator system enables an instructor to teach a crew intelligently to correct errors and, in particular, those which cannot be simulated in the air.

Effectiveness of the flight training process depends in large measure on the degree of sophistication of the method of evaluating quality of performance of flight assignments, with mandatory utilization of objective monitoring means. MSRP-64 onboard flight data recorder systems, for example, in combination with the Luch-74 automated flight information processing system, as well as airborne and ground TV systems are highly informative and efficient means of monitoring and verification. Innovators are presently hard at work in line units and at military educational institutions improving recorded flight information processing software.

Aviation engineers Lt Col A. Filippov and Maj V. Zhmerenetskiy approach their job inventively and conscientiously and display technical innovativeness and professional competence. The results of their efforts convince one that under certain conditions, with the aid of the MSRP-64 - Luch-74 system, one can quickly pinpoint typical aircrew mistakes in flying technique and operation of onboard systems.

Speed and efficiency in pinpointing aircrew mistakes, particularly instances of lack of discipline in the air, is extremely important for ensuring flight safety. By finding mistakes, one can determine the cause and prevent it from repeating.

Effectiveness of flight training in turn depends directly on how fast a pilot in training receives information on the quality of a training flight. Analysis of the flight data recorder tapes after landing, when all details of actions in the air are still fresh in one's mind, helps quickly determine the truth, helps eliminate the cause of an error, and stimulates innovative pilot activity to improve job skills.

Videotape systems possess a great deal of potential in this area. The advantage of a video recording over a conventional film is promptness of feedback, as well as the capability to add audio information to the image. A video tape can be played back over and over, freezing frames. While certain skills are required to read a graph produced as a result of processing flight data recorder tapes, a pilot receives on the TV screen (video monitor) "visual information" in a form to which he is accustomed, which greatly increases the effectiveness both of the debriefing between training sorties and the full postflight analysis session.

In order to improve objective monitoring results for aircraft landings, efficiency innovators from a certain unit -- Lt Col V. Shishkin, Capt Ye. Ivanov, WOs N. Podyachiy and S. Anisimov -- designed and built devices and developed methods of utilizing a TV equipment package. In particular, using a variable focal-length lens from a Krasnogorsk motion-picture camera made it possible to increase by severalfold the image of an aircraft on the screen. The required focal length is set with the aid of a mechanical viewfinder. A large-screen TV set with VCR is used for conducting a complete flight operations analysis.

As a result of truly innovative efforts on the part of efficiency innovators, pilots now can view video tapes of their landings right at the tower between training sorties. Experience indicates that this enables combat pilots to compare their subjective impressions with objective monitoring data and analyze their actions in detail. This training method is not new, but unfortunately its adoption in the units is proceeding slowly, although its benefit is obvious. I feel that commanders, staffs, engineers, and innovators should give some thought to this.

Also meriting attention is the use of VCR equipment to convey to the units information essential to flight personnel (video-cassette communications). In the opinion of specialists, information in this form has great psychological effect in comparison with information circulars.

Combined use of modern onboard recording devices and automated flight information processing systems, airborne and ground video tape recorders, which provide capability to obtain both formalized information as quick-analysis forms as well as visual information, will make it possible substantially to improve the effectiveness of post-sortie debriefing and

analysis, to increase the effectiveness of aircrew training, and will make a substantial contribution toward flight safety.

We should note that considerable reserve potential is to be found in utilization of digital computers which are elements of modern simulators and automated flight data processing systems. Experiments by efficiency innovators indicate that digital computers can be used for automated analysis of level of aircrew proficiency and for generating the initial data essential to the Air Force commander for decision-making. With the aid of a digital computer a commander can evaluate in detail not only level of proficiency but also the individual features of each pilot, can note deficiencies in his training, predict improvement in professional expertise, and provide incentive for his men to maintain a high level of flying proficiency.

Fuller utilization of the potential to be found in electronics makes it possible substantially to reduce the volume of documentation which is carried out in the process of flight training, to reduce unwarranted time expenditures on documentation processing, to increase the Air Force commander's labor productivity, and to create conditions for transitioning to "paperless" management.

As is indicated by the experience of vanguard units, unique devices and interesting visual aids which offer savings in time and resources also make it possible to increase flight training effectiveness. In military transport aviation units, for example, a full post-sortie debriefing and analysis session involves the use of projection equipment and specially-prepared performance monitoring materials. An analysis session takes 30-35 minutes, and its visual effectiveness and instructiveness are obvious.

Acceleration of scientific and technological advances is placing increasingly higher demands on the general and professional-specialization education of aviation personnel. The new aircraft, packed with electronics, require greater attention particularly toward flight personnel theory training. Professor G. Volkov has persuasively presented his thoughts on the role of theory training in the "pilot-machine" system. "The most complex, modern equipment will produce zero effect and soon go out of commission," he states, "if the level of knowledge applied in live labor is lower than the level of knowledge specified in this equipment."

This problem is not simple; it requires a combined solution. This is why inventors at military educational institutions and in the units are devoting considerable attention to it. Recently many various unique displays, working models, programmed-learning classrooms, and flight-procedure simulators using microelectronics, laser and video equipment have been designed and built for the purpose of intensifying the learning process. Improvement of existing and development of new audiovisual programmed learning booths is a promising area for inventors. Of course close cooperation with engineers and flight training methods specialists is essential. Their principal task consists in carefully selecting the most essential information to be assimilated by flight personnel and weeding out less important information about which only general knowledge is required. This approach implements the principle of individual and stage-



by-stage teaching, the requisite sum total of knowledge is firmly assimilated, and learning time sharply decreases.

Employment of technical means in flight training is economically warranted. Experience in using video equipment to provide objective monitoring of landings when transition-training over to a new aircraft in one of the units indicated that the cost of the video equipment is repaid more than 20-fold. Economy in resources is achieved primarily through reducing the number of gross errors during landing, and consequently by reducing the number of unscheduled dual training and check rides, that is, by reducing unproductive flying time.

The new revised CPSU Program states that thriftiness, intelligent expenditure of public funds, rational utilization of each and every ruble, elimination of wastefulness, various unproductive expenditures and losses is the business of the entire party, the entire people, the business of each and every workforce, each and every worker. This demand of the party applies in full measure to us aviation personnel, and particularly to commanders -- those who organize the complex training and indoctrination process. In order efficiently to expend costly aircraft resources, it is essential first and foremost to make maximum use of the possibilities of modern technical teaching devices, constantly to improve the methods of their employment, and to display innovativeness and initiative.

We must state that the question of improving training facilities exerts strong psychological pressure on some commanders, especially as regards allocation of resources. Evidently a role in this is played by an inability or disinclination to count, because in order to estimate effect it is necessary to perform a certain mathematical analysis. For example, refusal to allocate funds to purchase a motion-picture camera for a performance monitoring group should be viewed not as thriftiness but rather as wastefulness resulting from economic shortsightedness.

Analysis of present trends in the evolution of aircraft and technical teaching devices based on using computers indicates that the Air Force commander should possess a sufficient amount of knowledge in the field of cybernetics and electronics. In the very near future a commander who has failed to master the fundamentals of programming may fall hopelessly behind. For this reason improvement of training programs to raise the level of professional competence of the air commander and development of the required skills in using modern computers should be considered an urgent, priority task.

It is very important to ensure a closer link between higher educational institution science and the practical activities of line units and subunits. What is needed is more flexible and efficient interaction between flight training methods specialists and programmers, between academy scientists and

line unit commanders. On the one hand it is necessary to improve the computer literacy of the air commander, while on the other hand higher educational institution science should become a direct participant in the combat training process.

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## 12TH FIVE-YEAR PLAN TARGETS DISCUSSED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 6, Jun 86 (signed to press 5 Jun 86) pp 8-9

[Article, published under the heading "27th CPSU Congress: Aspects of Theory and Practice," by Candidate of Economic Sciences Lt Col N. Karasev: "Program of Constructive Building"]

[Text] One of the program aims of the 27th CPSU Congress is to accelerate our country's socioeconomic development, to attain a qualitatively new state of the Soviet society, profound transformation of its productive resources, and improvement of production relations. It is fully embodied in the Basic Directions of Economic and Social Development of the USSR for 1986-1990 and the Period Up to the Year 2000. The 12th Five-Year Plan plays a most important role in accomplishing the strategic objectives of these next 15 years. It should become a turning point in all areas of our work.

As is noted in the proceedings of the 27th CPSU Congress, the main task of the 12th Five-Year Plan consists in increasing the pace and efficiency of development of the economy on the basis of acceleration of scientific and technological advance, production retooling and upgrading, intensive utilization of created production potential, improvement of the system of administrative management and the economic management mechanism, and in achieving on this basis further rise in the level of prosperity of the Soviet people. This task defines the basic distinctive features of this next 5-year period and the more distant future.

An important feature of the 12th Five-Year Plan is an increase in the pace of development of the national economy. The dynamic nature of the economy is clearly and convincingly reflected in an increase in targeted incremental growth of the major economic indices. The average annual rate of growth of national income utilized for consumption and accumulation in the 12th Five-Year Plan will run 3.5-4.0 percent as compared with 3.1 percent in the 11th Five-Year Plan. Industrial output is to grow on the average by 3.9-4.4 percent annually, as compared with 3.7 percent in the last five-year plan. National income incremental growth will increase by a factor of 1.6 in the period 1986-1990. This indicator declined in the last five-year plan. Total national income volume is to reach a figure of 614 billion rubles in 1990, while industrial production volume is targeted to reach 1 trillion rubles.

Our economy will be characterized by such a highly dynamic nature and scale by the beginning of the last decade of the 20th century.

Another feature of the 12th Five-Year Plan is that it was drawn up with maximum consideration of the need to accelerate scientific and technological advance. The strategy of guidance of acceleration of scientific and technological advance embodied in the decisions of the 27th CPSU Congress is as follows: first of all, with science and technology advancing along a broad front, to concentrate available resources in key areas; second, to open up mass utilization of reliable, practically-proven technical innovations, in order to obtain maximum return until such time as they become obsolete; third, to conduct rapidly and purposefully scientific research and development which will ensure the development and adoption of fundamentally new equipment and technologies which boost labor productivity many times over. Accomplishment of these tasks is being made a practical reality in the 12th Five-Year Plan.

Established principles in planning have been revised in many respects. Major synthesizing indices of scientific and technological advance of branches and efficiency of such advance have been provided for the first time. In particular, for 1986 1,150 targets have been set for priority and interbranch areas of science and technology which are of enormous economic significance, including development of new generations of machinery and equipment. Targeted for the five-year plan as a whole is a 1.5-2-fold expansion of employment of advanced basic technologies, and the level of production automation is to be boosted approximately twofold. These indices are being established for the purpose of stimulating more active practical work by ministries, associations and enterprises to advance to the cutting edge of science and technology.

Within the framework of acceleration of scientific and technological advance, the CPSU aims to achieve a transformation on a truly historic scale -- accomplishment of a new technological renovation of the nation's economy. In order better to understand the significance of this problem, it is useful to bear in mind that the first all-encompassing rehabilitation of the entire USSR economy was carried out in the 1920's and 1930's. The building of a basically socialist society was the overall result of these efforts. Since that time branches and regions have been subjected to renovation, but not the entire economy as a whole. And now accomplishment of this task has been stipulated as an urgent matter for the entire party and people. And it is to be accomplished in an extremely short historical period of time.

The party has unwaveringly rejected the economic management stereotype which became established in the past, whereby new construction was considered the principal method of expanding production, while many existing enterprises went for years without retooling. The ratio of new construction to retooling and reequipping of existing enterprises is now decisively changing. The percentage share of resources channeled into renovation is increasing in the 12th Five-Year Plan from one third to one half of the total volume of capital investment in production. More than 200 billion rubles of capital investment -- more than in the preceding 10 years -- is to be channeled into renovation and retooling of production. By the end of the current five-year plan the production edifice is to be renovated by more than one third, including

facilities currently under construction, with 50 percent of the production equipment inventory new equipment.

The next specific feature of the 12th Five-Year Plan is implementation of an urgent economic and political task -- conversion of the nation's economy over to an intensive path of development. Improvement in end results is prescribed with a substantial decrease in incremental growth of major resources and a simultaneous improvement in all work qualitative indices. The Main Directions specify increasing societal labor productivity by 20-23 percent as compared with 16.5 percent in the last five-year plan. For the first time virtually all incremental growth in national income, industrial output and other production sectors is to be obtained by boosting labor productivity. Incremental growth of labor resources will decline during these years and total only 3.2 million persons. Without the targeted labor productivity growth, the economy would require an additional more than 22 million workers.

In conformity with the policy hammered out at the 27th CPSU Congress, there will be substantial acceleration of accomplishing such an important task as transforming the economy into the principal source of meeting additional requirements in fuel, raw materials, and other materials. From 60 to 65 percent of incremental growth of requirements in major resources is to be provided through this in the coming five years. As a result savings in material expenditures for the national economy as a whole will have doubled by 1990.

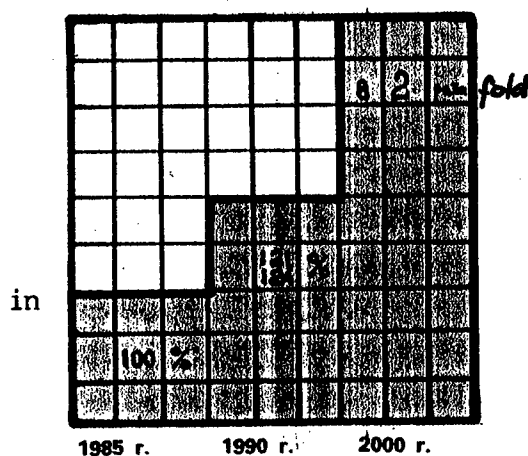
Practical completion of transition to the new methods of economic management, which have demonstrated their effectiveness, is one of the features of the 12th Five-Year Plan. Since January 1986 enterprises operating under the new conditions have been producing more than half of total industrial output. A timetable has been set for completing the changeover to the new conditions of economic management for the associations and enterprises of other branches of industry -- from 1 January 1987. Adoption of the new methods of administrative management in transportation, in the construction industry, and in our country's agroindustrial complex is expanding.

The CPSU Central Committee Political Report to the 27th CPSU Congress clearly spells out the principal directions of reorganization of the economic management mechanism. They include increasing the effectiveness of centralized direction of the economy and strengthening the role of the central echelon in achieving the principal goals of party economic strategy; decisive broadening of the limits of independence of associations and enterprises and increasing their responsibility for achieving optimal end results; changeover to economic methods of guidance at all levels of the economy; provision of management with modern organizational structures, taking into account trends in production concentration, specialization, and co-production; achievement of an optimal combination of branch and territorial economic management and integrated economic and social development of republics and regions; implementation of comprehensive democratization of management, an increased role by workforces in management, and strengthening of oversight from below.

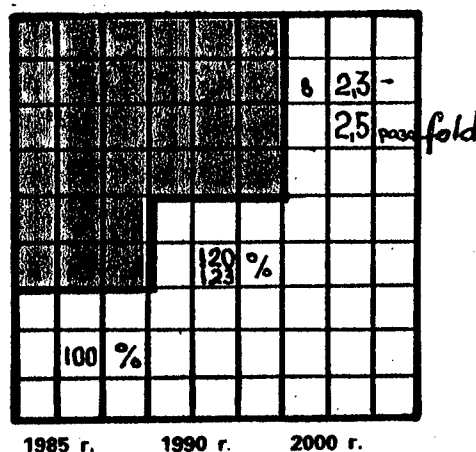
Programmatic goals of CPSU efforts in the economic area include a rapid rise in the people's living standards and comprehensive development of the individual.

Sometimes the formula "improvement in standard of living" is interpreted in an oversimplified manner: it is defined solely as growth in personal income and production of consumer goods. The party draws attention to the fact that in actuality the concept "standard of living" is much broader and richer. It includes continuous growth in people's awareness and level of sophistication, including intelligent consumption, exemplary public order, high quality of provision of services to the public, health care, rational diet, and full-valued utilization of leisure time from a moral-aesthetic standpoint. Precisely such an approach is fully reflected in the CPSU Program and in the Main Directions of Economic and Social Development of the USSR for 1986-1990 and the Period Up to the Year 2000. During these 15 years it is planned to double the volume of resources channeled into satisfying the needs of the people.

Industrial Output  
(growth based on 1985=100)



Societal Labor Productivity  
(growth based on 1985=100)



Particular importance is attached to strengthening the innovation content and collectivist nature of labor, to increasing its sophistication and encouraging highly-skilled and highly-productive work for the benefit of society. All this is directed toward promoting gradual transformation of labor into a vital need on the part of each and every Soviet citizen.

Everything necessary will continue to be done in the future to achieve steady growth of worker real income and further increase in the level of prosperity of all strata and social groups in conformity with our country's economic capabilities. Labor remuneration will continue to be the principal source of worker income through the first phase of communism. Public consumption funds will at the same time be growing at an accelerated pace. They are called upon to play an ever increasing role in development of the national systems of free public education, health care and social security, in improving worker rest and recreation conditions, etc.

Implementation of specified measures in the area of increasing labor remuneration and development of public consumption funds in the 12th Five-Year Plan will lead to genuinely tangible changes in living conditions and standard of living for the broadest segments of society. Income will increase for more than half of the people in our country just from national-level measures to boost pay, pensions and benefits. This is almost twice as much as in the last five years. By the end of the five-year plan more than 50 percent of all families will have an average monthly income per family member of more than 125 rubles.

One of the principal directions of party economic activity also consists in building a solid material foundation for strengthening the defense might of our homeland. Our society does not need an army from the standpoint of internal conditions. As is noted in the CPSU Program, however, as long as the danger that imperialism will initiate aggression, military conflicts, and various provocations continues to exist, it is essential to devote unabating attention to strengthening the defense might of the USSR and to strengthening its security. The party will continue in the future unfailingly to concern itself with ensuring that the combat potential of the Soviet Armed Forces constitutes a solid fusion of military expertise and a high degree of technical equipment, ideological firmness, organization and discipline on the part of personnel, and devotion to their patriotic and internationalist duty.

It was noted at the 27th CPSU Congress that, as a result of the arms race initiated by aggressive circles in the capitalist nations, the degree of danger of outbreak of another war is steadily rising. The possibility of militarization of space through the fault of the most reactionary forces of U.S. imperialism signifies a qualitatively new leap forward in the arms race, which would inevitably lead to disappearance of the very concept of strategic stability -- the basis for preserving peace in the nuclear age.

The 12th Five-Year Plan graphically demonstrates the peaceful, constructive nature of our aspirations.

The Soviet Union, together with the other socialist countries, consistently champions a firm intention in the world arena which is in conformity with the aspirations of all peoples -- to preserve and strengthen world peace, to halt and reverse the arms race, and to free mankind from the threat of a thermonuclear catastrophe. The entire world has witnessed the large-scale Soviet initiatives presented by CPSU Central Committee General Secretary Comrade M. S. Gorbachev in an official statement made in January of this year and in his address at the 11th Congress of the German Socialist Unity Party in Berlin. They are permeated with a strong feeling of responsibility for the destiny of peoples. These initiatives propose realistic ways to eliminate the threat of nuclear war, to reduce the level of military confrontation, and to establish throughout the world an atmosphere of trust, normal good-neighbor relations, and honest, mutually beneficial cooperation.

The USSR State Budget is characterized by stability of amount of financial resources allocated for defense, which also reflects the Soviet Union's peace-seeking policy. In 1986 our country's expenditures for strengthening the

defense might of the homeland could have been reduced and channeled into solving economic and social problems. The international situation, however, which has become aggravated through the fault of imperialism, makes it impossible to channel all of society's resources into development of the economy and improving the level of prosperity of the people.

Thus the main task of the 12th Five-Year Plan is defined taking into account further deepening of the scientific and technological revolution. It is directed toward changing our nation's economy over to an intensive path of development and advance by the Soviet economy to a higher level of organization and efficiency. And all this is for the sake of man, for the benefit of man.

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## Mi-24 HIND GUNSHIPS SHOT UP IN AFGHANISTAN REBEL ACTION

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 6, Jun 86 (signed to press 5 Jun 86) pp 15-16

[Article, published under the heading "They Were Decorated by the Homeland," by Military Pilot 1st Class Lt Col Yu. Kryukov: "Final Exam"]

[Text] Green flares surged upward into the pale blue sky -- the signal to head out. Before their trailing smoke had dissipated, the rotors of two pairs of combat helicopters proceeded to turn, the blades gradually merging into glinting disks. The crews had received their mission briefing the preceding evening. As Maj Aleksandr Filyasov, leader of the second pair, was running toward his helicopter, he felt a pressing emptiness in his chest. He frequently experienced this sensation just before going out on particularly difficult missions. But Filyasov knew that as soon as he closed the pilot's canopy and pressed the starter button, the nervousness would disappear and his mind would concentrate on the flight. This time as well, his will and composure returned as soon as the engines fired up.

The squadron's helicopter gunships took off daily into the troubled Afghan sky. The helicopter crews escorted truck convoys carrying food, medical supplies, fuel, and other goods essential to the population, providing air cover along the most dangerous stretches of road. Whenever the necessity arose, they would provide air support to DRA Army ground subunits and subunits of the limited Soviet force, when attacked from ambush by dushman [rebel] bands. The motorized riflemen had nicknamed the gunships "hunchback," the same name given to the famed Il-2 ground-attack aircraft in the last war. The Mi-24s performed brilliantly in any and all weather and climatic conditions.

The pair led by Maj A. Filyasov taxied to a takeoff position into the wind at the heels of the first pair. They lifted off and, climbing out, turned to their enroute heading. Adobe huts smoothly glided past, receding into the distance behind them. They passed the white cupola of a mosque; the light-blue tiles with which its walls were faced, the color of a hot summer sky, flashed by. A solid wall of mountains loomed up directly ahead.

Aleksandr Filyasov's gaze ran across the gauges in the strict sequence he had practiced and perfected as a student pilot, whereby one can see all instruments while not looking at any single instrument individually. With

every fiber of his being the pilot sensed the state of the helicopter, the operating parameters of the engines, and the helicopter's position in space. This familiar feeling of oneness with the equipment brought true joy. And the specific position of the needles on the gauges, the smooth, even roar of the powerful turbine engines, and the calm voices of his comrades, sounding minute by minute in his headphones, inspired confidence: the combat mission will be accomplished successfully.

But somewhere deep in his subconsciousness there lingered a feeling of inner uneasiness, which was keeping him from fully concentrating on the job at hand. Filyasov was familiar with this feeling, which appeared whenever a letter from home was late by a day or two beyond the expected arrival time. How were they? Was his daughter ill? But in the air, particularly when you are heading out on a combat mission, you are not entitled to "terrestrial" emotions, regardless of their cause.

Aleksandr forced himself to regain his composure and proceeded to peer more intently at the en-route terrain. The boulder-strewn ground below was incised by deep gorges and winding riverbeds. One must constantly be on one's guard! Any cave or rock cleft might at any moment erupt in flashes of heavy-caliber machinegun fire or the exhaust flame of a launched SAM missile. Waging an undeclared war against the DRA, international imperialism is supplying its hirelings with the most up-to-date weaponry, while the medieval fanaticism of the dushman forms the basis of their unprecedented ferocity.

The situation was quite complex at the present time. A dushman band, driven out of the town of Talukan by Afghan Army forces with the assistance of subunits of the limited Soviet force, had withdrawn into the mountains, to sit tight for a while and then again return to sow death and destruction. The bandits were departing from the plain by numerous narrow trails and mountain roads, hauling weapons, explosives, and various kinds of landmines. Afghan troops were in pursuit, but this is no simple matter on mountain terrain. In the mountains possibilities of engaging the counterrevolutionaries are appreciably limited. The dushman were making every effort to hold bridges and mountain passes, thus slowing the rate of advance of the DRA army ground units and subunits.

The four helicopters which included Maj A. Filyasov's crew were tasked with helping the Afghan troops get past one such point -- a bridge seized by the bandits. The risk was high, since the pilots would be unable to maneuver in the narrow gorge. There was an increased danger that the helicopter would take a hit. But fighting comrades were dying there in those mountains in combat with the dushman, and the crafty, cruel and treacherous foe was escaping into the mountains, evading just retribution. And awareness of the importance of their role gave our airmen boldness, courage, and determination.

The helicopters reached the designated area. Scarcely had the first armored personnel carrier bearing Afghan markings appeared from around a turn when it was hit by a dushman rocket launcher round, the sound echoing from cliff to cliff. Reacting to the hit, the hatches opened spontaneously from the impact, the APC shivered, and froze in place. The troopers poured out of the crippled vehicle under cover of smoke. The dushman intensified their hail of small-

arms and antitank rocket grenade fire. Filyasov watched with pain in his heart as two figures in gray uniforms, running from the APC, fell onto the hot, stony ground and lay there lifeless.

Both two-helicopter elements, without hesitation, continued on toward the wooden bridge across a turbulent mountain stream, under which, according to received intelligence, dushman lay in ambush. Muzzle flashes were coming from a line of boulders on the far bank. The pilots spotted several dushman, moving in short bounds to more advantageous positions. The aircrews realized that artillery fire could not be placed onto the bandits at the bridge. But an assault along the straight, narrow gorge without artillery preparation would result in unwarrantedly heavy casualties. The helicopter crews, delivering powerful, sure strikes from the air, were to play an important role in these conditions. And each individual now felt a particular sense of responsibility for the success of the mission.

The lead pair went right in to attack the target, but immediately came under fire from heavy-caliber antiaircraft machineguns. Filyasov noted that the element leader, not yet having delivered fire on the bandits, had nosed down and was rapidly losing altitude. The pilot finally got the nose up and recovered to level flight just short of the rocks below. Turning away from the bridge, he proceeded slowly climbing to a height at which he would be safe from the ground fire. The pilot coaxed the balky aircraft away from the sharp rock pinnacles and the streams of dushman machinegun tracer rounds. Filyasov could barely make out the words spoken by the voice in his headset: "Shaking violently. Control difficult. Returning to base. Complete the mission...."

Escorted by his wingman, the leader of the first element was forced to head for home. And the mission which was to be carried out by 4 helicopters now had to be done by a two-ship element, led by himself, Major Filyasov.

Muzzle flashes appeared here and there among the rocks by the bridge. Filyasov could see dushman wearing striped robe garments. They lay concealed like venomous snakes in the sparse brush along the river, waiting for the red-starred vehicles to pass above them and then fire at them from the rear. This is their usual tactic.

Pushing forward on the controls, Major Filyasov commenced an abrupt descent.

"Do as I do," he radioed his wingman.

Taking the dushman by surprise, the two helicopters headed toward the bridge along the narrow, winding riverbed. They were flying so low that they seemed to be practically touching the ground. The jagged granite cliffs flashed past, and dushman muzzle flashes appeared directly in front of them.

Cracks lacing out from bullet holes twisted across the thick canopy glass. Aleksandr suddenly felt the sensation of a blunt iron finger poking into his right hand, which was grasping the helicopter control stick. The craft was heading for the cliffs. But at the last second Filyasov succeeded in turning the helicopter away from the sheer granite wall and, biting into his lip and drawing blood, bringing the craft back on course.

The bridge lay ahead, with the crippled APC just short of the structure. He could see the tiny figures of dushman bustling around an antiaircraft machinegun. Pain shot up his arm clear to the shoulder at the slightest movement of the controls, making its presence felt throughout his body. There was blood on his light-colored flight suit, and there was blood on the floor of the cockpit. But Filyasov did not let up. He did not want his weapons operator or wingman to know his condition. Let them continue to hear his crisp radioed commands. Displaying incredible self-control, he continued directing the element's actions.

They hit the dushman with a salvo of rockets. The helicopters flew a second pass, and another one.... The rockets were striking with precision, right under the bridge. As he pulled up from his final pass, Filyasov saw out of the corner of his eye that the first APCs bearing Afghan markings were proceeding across the bridge. Mission accomplished. An enormous exertion of emotional and physical energy had been required to accomplish it! He had managed to carry out his assigned task, but the ordeal was not yet over. He had to get his aircraft back to the field. Did he have the strength? He had lost a great deal of blood, and his wound was causing incredible pain. But he had to hold out!

The rocky banks of a mountain river were flashing past the helicopter; the pilot's hand, in a blood-soaked kidskin glove, numbly clutched the control stick. The pilot was flying his aircraft home....

What was Aleksandr thinking about during these moments? He thought about his wife and his little daughter, who were waiting for him back home. In his mind's eye he saw the Volga, on the banks of which he had been born and grown up. There he had attended young cosmonauts school, worked as a benchworker-mechanic at a factory, and later enrolled in and graduated from flight school in Syzran.... He saw the faces of his father and mother and his military comrades. These visions had long ago merged into a single, content-filled concept for flight commander and party member Military Pilot 1st Class Aleksandr Filyasov -- homeland. Wherever he was stationed, wherever he carried out his difficult duties of military service -- in the forests of Karelia, in the mountains of Tajikistan, in Afghanistan, carrying out his internationalist duty as a member of the limited Soviet force -- at all times and in all places he acted as a true son of his great homeland, a worthy successor to the fame of our fathers and grandfathers.

Maj A. Filyasov lived up to the faith of his comrades in arms on this occasion as well. When the squadron commander drove up to the helicopter with the gaping holes in the cockpit canopy, which had just landed at its home field, Aleksandr, pushing away the flight technician who was holding him up, raised himself to full height and reported in a crisp voice: "Mission accomplished!" He was unable to do just one thing -- to raise his hand to his headgear in a salute, as regulations required....

Maj A. Filyasov was awarded the Order of the Red Star for courage and skill displayed in performance of a critical mission. After he left the military hospital, this officer continued rendering internationalist assistance to the

people of the DRA. He flew several hundred combat sorties in his 355-day tour of duty in this country. And on each occasion he displayed fearlessness and a high degree of professional skill. Filyasov has also been awarded the Medal of Valor, the Distinguished Service Medal, and several decorations of the Democratic Republic of Afghanistan.

Major Filyasov is presently enrolled at the Military Air Academy imeni Yu. A. Gagarin. An A student, secretary of the department party organization, an exemplary officer, a modest and responsive comrade, he enjoys great respect both on the part of academy students and faculty.

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NEW BOOK 'EXPOSES' NATO SUBVERSIVE PROPAGANDA

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 6, Jun 86 (signed to press 5 Jun 86) p 17

[Article, published under the heading "Assisting the Propagandist," by Lt Col N. Merkulov: "NATO Psychological Aggression"]

[Text] Perhaps at no time since the war has the world situation been so explosive, complex and inauspicious as in the first half of the 1980's, it was noted at the 27th CPSU Congress. Today millions of people throughout the world feel a sense of growing alarm. It is caused by the openly militaristic, warmongering policy being pursued by ruling circles in the United States and its NATO allies, which are nurturing insane plans of total supremacy, which are pushing mankind to the edge of a nuclear catastrophe.

In order to prop up its hegemonistic policy and whitewash it in the eyes of the world community, the United States is actively and in a systematic manner seeking to exert massive influence on the consciousness of the masses, including the peoples of the socialist nations. The Central Committee Political Report to the 27th CPSU Congress stressed that in no other period of its existence has mankind experienced such pressure of hypocrisy and deception as at the present time. Bourgeois propaganda is inundating people throughout the world with skillfully juggled information, foisting ideas and sentiments, and programming a civic and social position which is advantageous to ruling forces. Psychological aggression of unprecedented scale and brazenness is being directed against the Soviet Union and the other socialist countries. It has essentially become a part of U.S. governmental and military policy.

An elaborate information-propaganda service has been established in the United States, which is a component part of NATO's ideological system. The United States alone spends more than 7 billion dollars each year on the operation of this system. "The 'psychological warfare' unleashed by imperialism cannot be characterized other than as a special form of aggression, information imperialism, which tramples the sovereignty, history, and culture of peoples," it was stressed at the 27th CPSU Congress. "It also constitutes outright political and psychological preparation for war...."

Behind-the-scenes activities by the ideological machine of imperialism are faithfully and persuasively shown in a book by internationalist-journalist Yu.

Nalin entitled "Sdelano v NATO" [Made in NATO] (Moscow, Molodaya Gvardiya, 1985, 334 pages -- "Imperialism: Events, Facts, Documents" -- price 70 kopecks). It will be of interest for regular staff and volunteer propagandists, political instruction group leaders, and all ideological activists to learn in greater detail about the work methods and directions being taken by NATO ideologists and their methods of organizing ideological sabotage. A particularly valuable aspect of this book is the fact that the author investigates NATO subversive activities directed against youth -- that category which comprises the bulk of today's Armed Forces. He examines in detail the system of ideological influence on youth at general-curriculum schools, higher educational institutions and, finally, in the NATO-bloc armed forces.

The author devotes considerable attention to analysis of new traits and features which have recently appeared in NATO psychological warfare activities. One can clearly see an attempt on the part of ruling circles in the imperialist nations to take over control of the means and direction of external and domestic propaganda in order to coordinate its activities and give it an anti-Soviet, anti-Communist directional thrust. This trend is being given all-out support and is being cultivated at the level of the White House, State Department, and Pentagon. The author quotes U.S. public affairs commentator (Dzh. Seldes): "All ethical standards of journalism in the press and radio no longer apply when one is dealing with Russia. Here we can do everything we choose. There are no limits. Say anything you like, lie if you wish -- nobody will stop you.... A lie will be treated with indulgence."

Another new feature is the fact that military-industrial complexes are increasingly gaining control over the media. Many companies which are directly or indirectly working in the cause of war, supplying arms and equipment to NATO forces, today stand behind the apologists and heralds of imperialism.

There is one additional new feature -- more active participation by representatives of the highest level of U.S. governmental and NATO authority are taking an increasingly active part in organizing and carrying out acts of ideological sabotage. They are willing to set the tone of anti-Soviet provocational attacks and propaganda campaigns of various kinds. With rare exceptions President Reagan does not touch upon Soviet-U.S. relations in his weekly TV and radio appearances. And as a rule the Soviet Union's position is presented in a distorted, twisted form.

In the United States and the NATO countries, speeches by pillars of governmental authority are always preceded by preliminary "brainwashing." It follows a definite scenario. First an appropriate article or news item appears in an extreme rightwing periodical. Subsequently the topic is further developed on the pages of bourgeois newspapers, on television and radio. Public organizations and news agencies providing news to other countries join in; news bulletins and "research" materials are released. In order to make the propaganda materials attractive, they are nicely laid out and distributed free of charge. The next phase involves extensive coverage of the issue in government circles, legislative bodies, in statements by officials, as well as attempts to force the issue onto the discussion agenda in international

organizations. The ultimate objective of such a propaganda campaign is to obtain "censure," "sanctions," "protests" by the world community directed against a given country or government, most frequently the USSR and its allies as well as the armed forces of the Warsaw Pact member nations.

Appropriate facilities for cooking up psychological warfare recipes and for training cadres of anti-Communist theoreticians and practical propagandists are required in order to conduct such campaigns on a large scale. Such facilities exist. In the United States alone more than 150 institutes and scientific organizations and approximately 200 university departments specialize in the elaboration of anti-Communist doctrines. Virtually all U.S. universities and colleges take part in one way or another in implementing social aims within the framework of the "crusade" against communism.

Acts of ideological sabotage against the countries of the socialist community and attempts to create conditions for the "erosion of socialism from within" are among the most important tasks of NATO information-propaganda activities. The book's author uses specific facts to enable the reader to trace the propaganda methods and fanatically barbaric devices in the arsenal of this imperialist bloc and which are aimed at undermining the socioeconomic foundations of the Soviet State and the other socialist countries, at eroding away our ideological underpinnings, and at diminishing the prestige and influence of the USSR in the international arena. Bourgeois ideologists aim first and foremost at military personnel of the Soviet Armed Forces and the armed forces of the Warsaw Pact member countries. This hostile propaganda is frankly intended for individuals who have an uncritical attitude toward it, who sometimes accept on faith a patent lie.

At the same time the NATO propaganda machine seeks to frighten the public in the NATO countries, to get them worked up with a lie about "Soviet expansion" and to make them more compliant toward financing military expenditures.

Demonstrating how the psychological actions on the part of the class enemy are failing one after the other, the author issues a passionate appeal to work hard and persistently to prevent a world military conflict, to gain people's minds and hearts, and to increase political vigilance.

Yu. Nalin's book "Made in NATO" will greatly assist ideological activists in their efforts to expose bourgeois ideology and in further strengthening the ideological conditioning of Air Force personnel.

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## PEACEFUL AIMS OF SOVIET SPACE PROGRAM STRESSED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 6, Jun 86 (signed to press 5 Jun 86) pp 26-27

[Article, published under the heading "Delegates to the 27th CPSU Congress Speak," by Lt Gen I. Kurinnyy: "Peace in Space, Peace on Earth"]

[Text] The 27th Congress of the Communist Party of the Soviet Union was a notable event in the life of Communists, the Soviet people, and the fighting men of the USSR Armed Forces. The CPSU Central Committee Political Report, presented by CPSU Central Committee General Secretary Comrade M. S. Gorbachev, made a deep, ineradicable impression on everybody present in the conference hall. It essentially set the tone for a businesslike, incisive, direct and demanding discussion and defined an innovative approach to solving the urgent problems facing our society. The congress demonstrated once again to the entire world that, no matter how great the successes of the Soviet State, the party is not afraid to tell the people about mistakes and errors which have been made and which have prevented achieving even higher results in economic and social development. Precisely this constitutes vivid evidence of the strength and indisputable superiority of the socialist over the capitalist system. The party's faithfulness to Leninist principles and traditions was once again graphically manifested in this.

High praise for the military labor of Soviet servicemen, contained in the CPSU Central Committee Political Report, evoked a feeling of strong thankfulness and gratitude to our Communist Party. The delegates listened with great enthusiasm to the statement that the CPSU will continue in the future maintaining our country's defense capability and the combat might of the Armed Forces at a level making it possible reliably to defend the peaceful labor and peaceful life of Soviet citizens.

The entire proceedings of the 27th CPSU Congress convincingly demonstrated that our party faithfully serves the interests of the people and is unwaveringly leading the people along a Leninist course. The Soviet space program has achieved considerable success under party guidance.

The Soviet Union is a pioneer in space. In the 29 years since the launching of the first Soviet artificial Earth satellite and the quarter of a century since the launching of the spacecraft Vostok, carrying the world's first

cosmonaut, Yuriy Gagarin, a gigantic leap forward has been taken in the peaceful exploration and development of space. Mankind has essentially commenced the habitation of circumterrestrial space. Hundreds of satellites are presently in orbit, and scientific orbital stations, with crews relieving one another and working on board for months at a time, are on a permanent operating status. Unmanned interplanetary probes are plying the depths of the Solar System. With their help we are engaged in a systematic study and investigation of the planets, the Sun, and the interstellar medium. The first images of the nucleus of Comet Halley were obtained with the aid of the Soviet Vega 1 and Vega 2 space vehicles. Launching of the new-generation Mir [Peace] orbital scientific station from the Baykonur launch complex in honor of the 27th CPSU Congress constitutes another vivid evidence of our achievements in space exploration. This station signifies, both by its name and purpose, the peaceful aspirations of our space program.

As a delegate to the 27th CPSU Congress, I happened to meet at the Baykonur space launch center with the launch team preparing to launch the booster and and the Soyuz T-15 spacecraft, crewed by cosmonauts L. Kizim and V. Solovyev. This new space mission was the first step in the Soviet manned space program toward carrying out the historic decisions of the party congress, which spelled out our country's strategy in this turning-point phase of development. It is profoundly symbolic that the cosmonauts are carrying out in full view of the entire world the program connected with getting the new Mir orbital station into operation and are once again demonstrating our country's striving not toward "Star Wars" but toward "star peace."

I was particularly pleased at the opportunity to offer congratulations at a State Commission meeting to Leonid Denisovich Kizim, who hails from the same area I do, and his comrade in arms Vladimir Alekseyevich Solovyev, on their confirmation as primary crew. They are well acquainted with life in orbit. Nevertheless we are clearly aware that strenuous work in space has not and never will become a routine, commonplace activity. Every space mission requires enormous labor, serious training and preparation, profound knowledge, and the greatest courage. Two of the finest members of the cosmonaut corps were selected for this mission, and we are justified in our expectations that they will justify with honor the confidence which has been placed in them.

Space hardware affords the opportunity to obtain unique information for gaining knowledge of the world around us, for solving such terrestrial problems as the search for raw material and energy resources, environmental monitoring, improvement of technology and information support of science and the economy. The task of setting up five-zone TV broadcasting, for example, specified by the 26th CPSU Congress, has been fully accomplished with the aid of Molniya, Raduga, Gorizont, and Ekran satellites. Today the Soviet population virtually is able to view Central Television programming on a regular basis anywhere in the country. Meteor satellites enable us to forecast the weather with greater accuracy. Thanks to these satellites scientists are standing at the threshold of accomplishing a highly complicated task -- preparing two- and three-week weather forecasts, which is already generating enormous economic benefit. Manned orbital stations and spacecraft as well as Kosmos and Meteor satellites are being used to investigate Earth resources, for management of natural resource utilizing branches,

environmental monitoring, and maritime navigation. More than 850 scientific, design, survey and prospecting organizations are making use of satellite imagery, which is making it possible to obtain an overall estimate of an area's natural resources and economic potential from 3 to 4 times faster and 12 to 15 times cheaper than with traditional methods.

This is an example of the acceleration which has become a sign of our times. Its embodiment, as was indicated at the 27th CPSU Congress, will have far-reaching consequences for the destiny of our homeland. This course of policy enjoys the enthusiastic and broad support of workers in the Soviet space program.

Space systems provide the capability to receive on a regular and immediate basis information on climatic and weather conditions, to observe progress in northward recession of snow cover, breakup of the ice in rivers and spring floods, thawing of the soil and soil temperature, to determine the state of grazing lands, the readiness of fields for planting, and to monitor crop development, maturing, and harvest. Our country is presently standing at the threshold of establishing a permanently-operating service to monitor crops from space. It will help intensify implementation of the Food Program.

Experiments conducted on board orbital stations serve the cause of peace, scientific and technological advance. They have opened up capabilities to obtain in conditions of weightlessness high-quality semiconductors and ultrapure optical materials, new alloys and pharmacological products.

We could go on with the list of peaceful space-related professions. It is broad and diversified. Space offers unbounded potential and inexhaustible opportunities. Such unique properties as weightlessness, high vacuum, unlimited heat absorption capacity and sterility are opening up the road to industrialize space. That time is not far off when orbital factories and shops will be built, to produce materials possessing qualitatively new properties.

Peaceful cooperation in space is the only correct path of development of this new area of human activity. The Interkosmos Program offers examples of implementation of large-scale international space projects. One distinctive feature of cooperative endeavor by the 10 socialist countries is a combination of basic and applied research, which brings genuine benefit to their economies. The international Intersputnik organization and satellite communications system meets the requirements of the nations of the socialist community in telephone, telegraph, radio, and TV communications. Joint efforts in the area of satellite meteorology are greatly increasing the promptness and efficiency of the weather service. The Vega project is an example of broad basic research.

Today the Interkosmos Program not only has a rich history but also a powerful scientific and technological foundation. Utilization of the strongest aspects of each of the partners makes it possible to solve the most complex problems brought forth by scientific and technological advance.

Future space research programs presume a transition from utilization of individual vehicles to the development of specific-purpose space systems and the development of highly reliable and long-lived specific-purpose space systems.

The USSR is also engaged in joint space research with capitalist countries. Such cooperation has been going on for 20 year now with France. Instruments developed by French specialists have been carried by almost 30 Soviet space vehicles. Three French satellites have been lifted into orbit by Soviet boosters. French astronaut Jean-Louis Chretienne was a member of a Soviet manned mission and served as a member of an international crew on board the Salyut 7 station. A total of approximately 40 joint Soviet-French experiments have been conducted in past years.

Cooperation in space with India is developing successfully. India has developed its own booster rocket with the assistance of the Soviet Union. In 1984 Indian astronaut Rakesh Sharma, as a member of an international crew on board the Salyut 7 station, conducted a number of scientific experiments which were of great significance for India's science and economy.

The FRG, Austria, and Sweden have taken part in a number of projects.

Successful accomplishment of the large-scale international project to investigate the planet Venus and Comet Halley, involving the participation of large teams of scientists and specialists from socialist and capitalist countries, demonstrates the genuine possibilities and extensive prospects for peaceful exploitation of space with the unified efforts of various countries.

The KOSPAS-SARSAT international satellite search and rescue system for ships and aircraft in distress, based on Soviet and U.S. satellites, is producing effective results. A total of 550 persons were rescued with the aid of this system between 1982 and February 1986. Participants in this program, in addition to the USSR and the United States, include Canada, France, Great Britain, and Norway. Other countries have also expressed interest.

Cooperation between the USSR and the United States -- countries which possess greater economic and scientific-technical capabilities for this purpose than other countries, should play an important role in the investigation of space in the interest of all mankind. A good beginning has been made in this direction. We might recall the successful joint mission flown by Soviet and U.S. spacecraft in 1975. In May 1977 an agreement between the USSR and the United States was signed in Geneva, dealing with cooperation in peaceful exploration of space. It prescribed the conduct of research in the fields of medicine, meteorology, the environment, as well as joint experiments by the Salyut and Space Shuttle.

These plans were not fated to come to fruition, however: U.S. reactionary forces, opponents of international detente, have given their space programs a militarist slant and an aggressive thrust. The scale and intensity of efforts in this area are indicated by the fact that expenditures for the first phases of the "Star Wars" program, initially designated at 26 billion dollars, have now grown to 50 billion dollars. They were increased by 75 percent for fiscal

year 1985/86, and in the future they will double. The danger is further intensified by the fact that the United States is endeavoring actively to enlist to participation in its adventuristic plans the economic and scientific potential of its aggressive NATO bloc allies, as well as Japan, Israel, and other countries. All this is causing serious concern and alarm on the part of the peace-loving public.

"This is not the first time we have encountered this situation," stated CPSU Central Committee General Secretary Comrade M. S. Gorbachev in his closing address at the 27th CPSU Congress. "Even today aggressive militarist forces would of course prefer to perpetuate confrontation. But what are we to do, comrades? Slam the door shut? This may be precisely what they are trying to get us to do. But we are clearly cognizant of our responsibility for the fate of our country and for the fate of the world. For this reason we have no intention of playing into the hands of those who would force mankind to accept the fact of nuclear threat and arms race."

The CPSU and Soviet Government, as is noted in the Central Committee Political Report to the 27th CPSU Congress, will continue in the future organically to combine in their policy a tireless struggle for peace with readiness to offer a solid rebuff to any aggression.

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## AIRCRAFT CONTROL AT HIGH ANGLES OF ATTACK

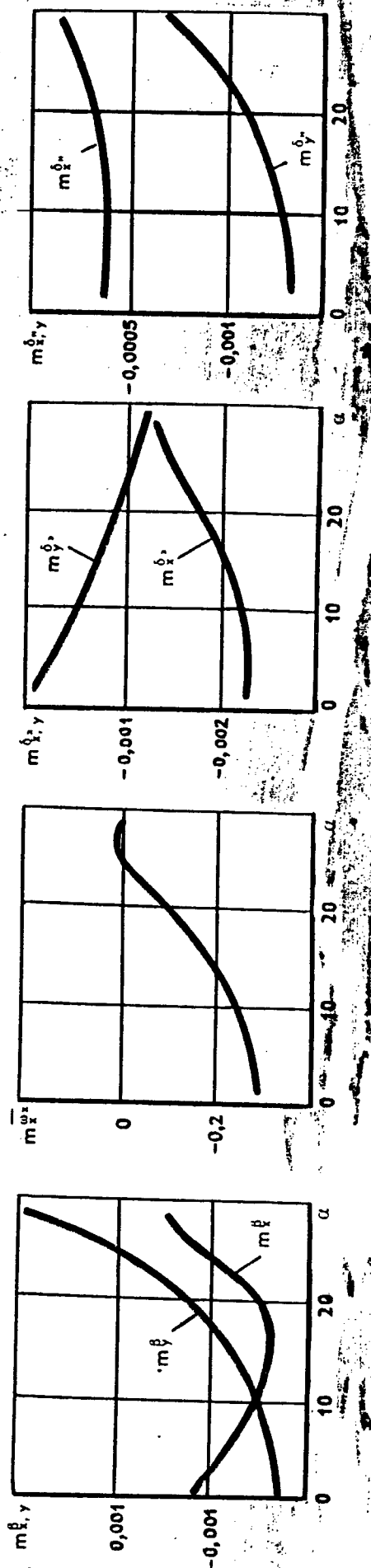
Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 6, Jun 86 (signed to press 5 Jun 86) pp 28-29

[Article, published under the heading "Practical Aerodynamics for the Pilot," by Doctor of Technical Sciences and Docent Lt Col V. Bukov and Candidate of Technical Sciences Maj A. Akimov: "Control at High Angles of Attack"]

[Text] Sure and safe handling of an aircraft at high angles of attack enables one to gain superiority in modern air-to-air combat. We shall examine some specific features of aircraft behavior in these conditions.

First of all we should state that an adverse change in lateral motion characteristics makes it necessary to limit the range of usable values of coefficient of lift  $C_y$ . Practical experience indicates that as angle of attack  $\alpha$  increases, aircraft stability and controllability in lateral motion deteriorate.

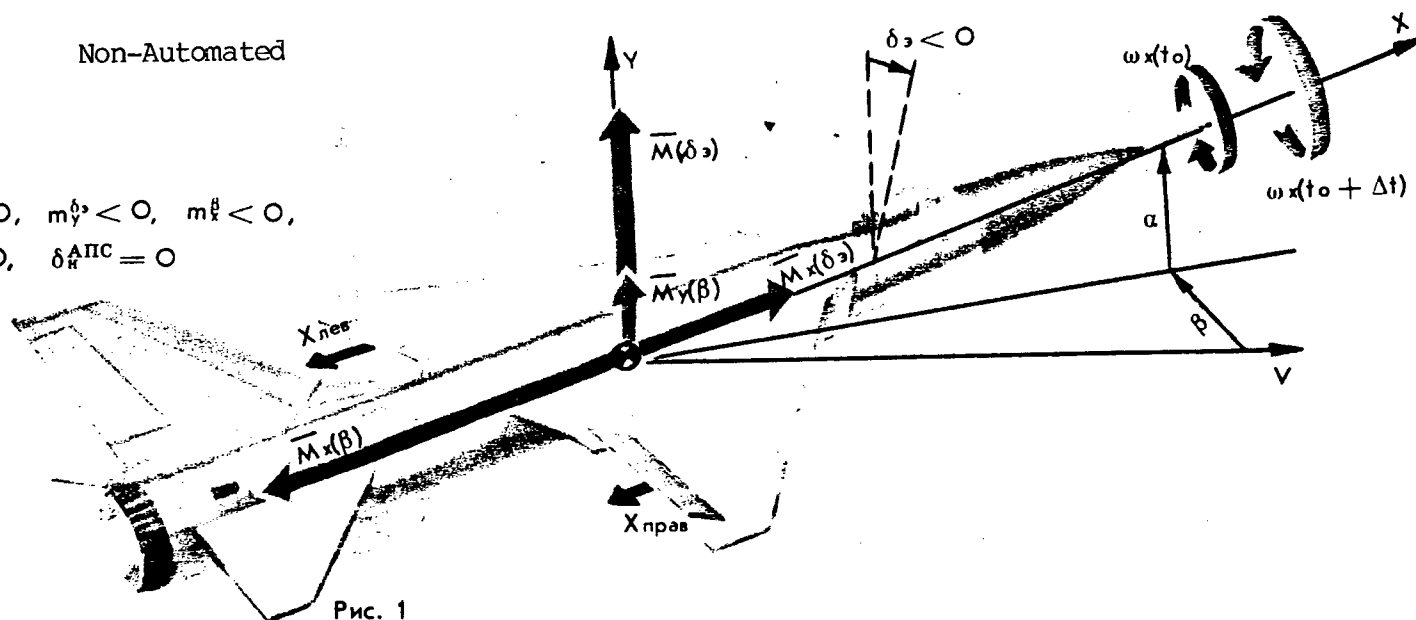
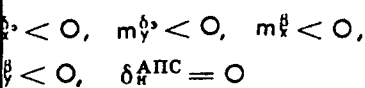
Stability is determined in large measure by coefficient of directional stability  $m_{\beta y}$  and coefficient of lateral stability  $m_{\beta x}$ . Figure 3 (back cover) shows how they change with increase in  $\alpha$ . At low angles of attack both aerodynamic moments ( $M_{\beta y}$  and  $M_{\beta x}$ ) seek to correct slip angle. With an increase in  $\alpha$ , as a consequence of tailfin immersion in the vortex flow, directional stability worsens and coefficient  $M_{\beta y}$  decreases (here and henceforth absolute magnitude shall be implied). At the same time, with an increase in  $\alpha$  there is a decrease in the effective sweep angle of the advancing wing and an increase in that of the trailing wing. As a result difference in lift between wings increases, and correspondingly there is an increase in coefficient  $M_{\beta x}$ . As a result, when a slip occurs an aircraft vigorously seeks to correct it essentially by banking on the trailing wing. Turning on its longitudinal axis, the aircraft begins to slip onto the other wing. Oscillatory instability of lateral movement occurs. With a further increase in  $\alpha$ , coefficient  $M_{\beta x}$  decreases, while  $M_{\beta y}$  becomes positive. In this case, during slipping or yaw, a destabilizing moment will act upon the aircraft, increasing the slip angle, which causes the aircraft to turn. This corresponds to aperiodic instability.



Loss of stability can lead to aircraft stalling. Attempts by the pilot to counter the aircraft's spontaneous oscillations are not always successful, however, due to delay in control actions and a substantial change in controllability characteristics.

Loss of controllability is manifested in a decrease in available angular rate of bank  $\omega_x$ , as well as in the occurrence of aircraft inverse response to movement by the control stick in the direction of bank (a diagram of this phenomenon is shown in Figure 1 on the back cover). This is connected with the fact that at high  $\alpha$  angles, aileron effectiveness diminishes, and coefficient  $M_{\delta^x}$  decreases (aileron effectiveness decreases as various lateral control devices). A substantial role is also played by kinematic crosslinking of angles of attack and slip, which occurs when an aircraft is turning on its longitudinal axis. Slipping creates moment  $M_{\beta}$ , which impedes rotation. In addition, when ailerons are deflected, aileron yawing moment  $M_y$  ( $\delta^y$ ) occurs due to difference in drag on the left and right wing  $x_l > x_r$  (looking in the direction of the moment vector, aircraft rotation caused by that moment runs clockwise). It promotes the occurrence of a slip angle onto the right wing, in the direction of which the pilot would bank. In conditions of possible loss of directional stability ( $M_{\beta} > 0$ ), yawing moment from slipping  $M_y$  ( $\beta$ ) can also promote the development of adverse slipping, which is added with the slipping from crosslinkage. Since aircraft lateral stability remains ( $m_{\beta} < 0$ ), when slipping occurs there develops moment  $M_x$  ( $\beta$ ), opposite to the control moment  $M_x$  ( $\delta^x$ ) generated by the ailerons. We should note that when the ailerons deflect, at first angular velocity  $\omega_x(t=0)$  of the desired sign occurs. However, as a result of development of slipping, after time  $\Delta t$  the direction of rotation corresponds to  $\omega_x(t=0 + \Delta t)$ ,

### Non-Automated



Improvement in control can be achieved either by optimizing the aircraft's aerodynamic layout or by utilizing stability and controllability systems (SUU) and angle of attack limiting systems. In both instances the aircraft is ensured properties which make it possible to use high angles of attack with confidence and effectively during maneuvering.

A roll damper and yaw damper with automatic directional stability (APU) is a component part of the SUU. These devices operate according to the following relationships:

$$\begin{aligned}\delta_3^A &= \kappa^{\dot{\omega}x} \dot{\omega}_x + \kappa^{\omega x} \omega_x, \\ \delta_H^A &= \kappa^{\omega y} \omega_y + \kappa^\beta \beta,\end{aligned}$$

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aircraft stable. In actual practice it is very difficult precisely to measure angle of slip. Therefore most frequently APU utilize transverse load factor  $n_z$ . The control relationships look as follows:  $\delta_A - n = k - p_z - p_z$ . Transverse load factor is linked with slip angle by well-known formula  $n_z = C_{\beta} \beta - z - \beta - q_s / G$ , from which it is apparent that a different load factor corresponds to one and the same slip angle at different dynamic pressures  $q$ . Therefore transfer coefficient  $k - p_z$  must be increased with a decrease in dynamic pressure. In addition, it should also increase with an increase in angle of attack.

Countering undesirable lateral motion, these devices help fly an aircraft at high angles of attack.

An automatic unit for crosslinking (APS) control signals in lateral and directional channels is another component of the SUU. Rudder countering slip is also used here for roll control. Components carrying indirect information on the magnitude and direction of potential slip are also introduced into the roll control equation. These include angular velocity of roll and control stick (ailerons) lateral deflection. The rudder is deflected on the basis of these signals, countering the occurrence of inhibiting slip. The APS equation is as follows:

$$\delta_{\text{APC}} = k_{\omega_x} \omega_x + k_{\epsilon} \delta_{\epsilon},$$

where  $k_{\omega_x}$  is the amount of rudder deflection proportional to roll rate;  $k_{\epsilon}$  -- rudder deflection proportional to aileron deflection (control stick roll motion).

One should bear in mind that with large aileron deflections the required rudder deflection may exceed the maximum available, which will lead to development of slip and loss of controllability. To prevent this, roll ( $k_{\epsilon}$ ) transfer coefficient  $k_{\epsilon}$  from the control stick to the ailerons automatically changes in relation to angle of attack (Figure 1). Available aileron deflection  $\delta_{\epsilon} = k_{\epsilon} - \epsilon$  also decreases by reducing this coefficient. At the same time one can increase coefficient  $k_{\epsilon}$ . With optimal coefficients  $k_{\epsilon}$  and  $k_{\omega_x}$ , the APS turns the aircraft not relative to its longitudinal axis but rather to the velocity vector, that is, without slip (Figure 2 on back cover). Thus the APC makes it possible to retain lateral controllability up to considerable angles of attack. At the same time flight personnel must be aware that roll control in these conditions should be proportional and smooth, since the aircraft is less responsive to rudder. This is due to its greater inertia in the yaw channel in comparison with the roll channel.

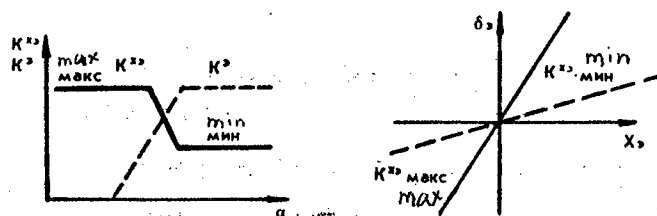


Рис. 1.

$$M_x(\delta)\Sigma = M_x^{\delta\omega} \cdot \delta\omega + M_x^{\delta\alpha} \cdot \delta\alpha,$$

$$M_y(\delta)\Sigma = M_y^{\delta\omega} \cdot \delta\omega + M_y^{\delta\alpha} \cdot \delta\alpha,$$

$$\delta\alpha_{\text{АПС}} = K^{\omega}\omega_x + K^{\alpha}\delta\alpha$$

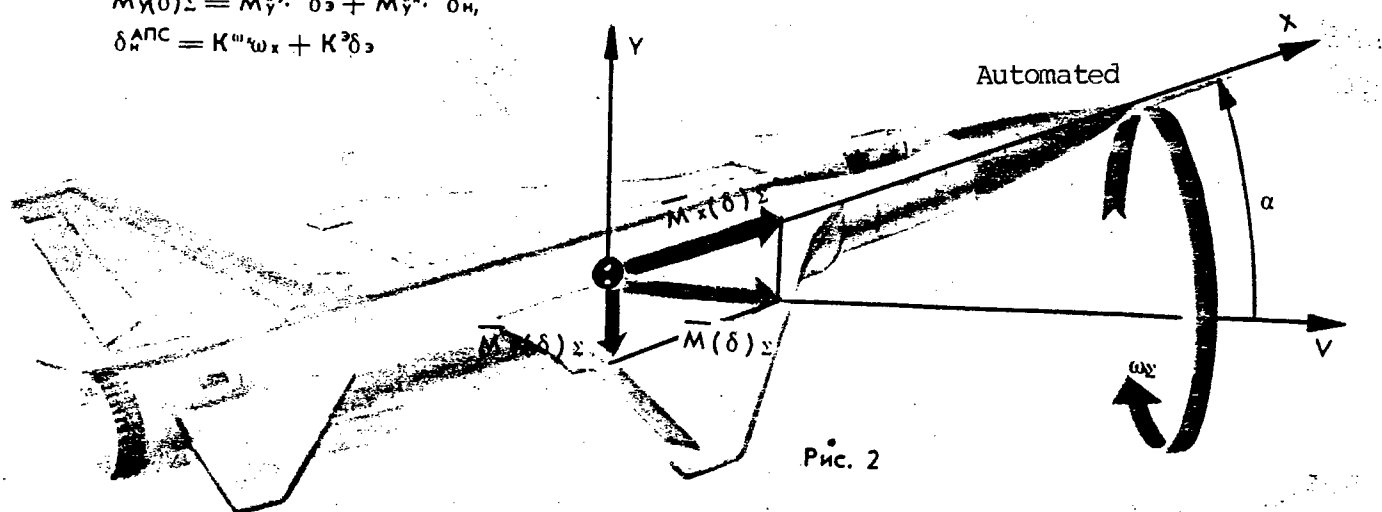


Figure 2 [back cover]

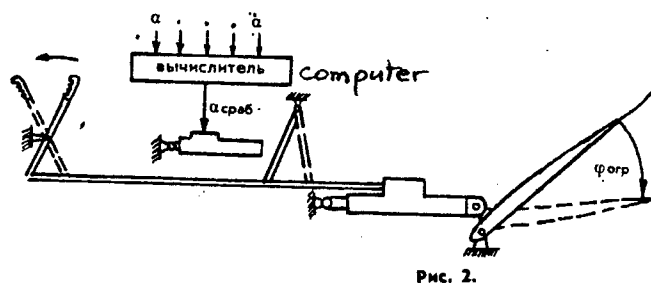


Figure 2.

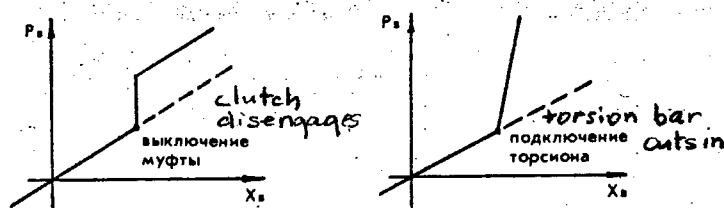


Рис. 3.

Figure 3.

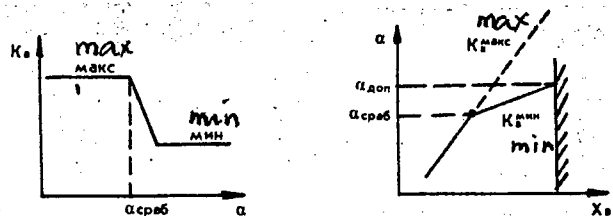


Рис. 4.

Figure 4.

Beginning with certain fairly high angles of attack, aerodynamic effectiveness of control surfaces (Figure 3 on back cover) drops off to such an extent that SUU becomes ineffective. The aircraft should not be flown at angles of attack greater than  $\alpha_{all}$ . Angle of attack indicators and annunciator lights, as well as so-called "automatic prompts" are used as warning signals upon approaching  $\alpha_{all}$ . These devices, which indicate approach to the maximum limit, prompt the pilot how to respond in the given situation. Control stick shakers, lever-pulse warning, etc are used as actuators. The direction of their operation should correspond to the pilot's habitual reflexes.

Automatic limiters, in which monitoring of approach to  $\alpha_{all}$  and countering tendency to exceed it are accomplished automatically, correspond to the highest level of automation. These devices operate according to the following equation:

$$\alpha_{срзб} = \alpha_{доп} - (\Delta\alpha_{ст} + k\dot{\alpha}),$$

where  $\Delta\alpha_{ст}$  is a static lead caused either by pilot delay or by dispersion of characteristics of actuation of the given devices;  $k\alpha$  is an overriding element which reduces the degree to which angle of attack exceeds the allowable value by figuring in its rate of increase.

Figure 2 contains a functional diagram of the automatic angle of attack limiter. A hydraulic cylinder acting simultaneously on the stabilizer and control stick is used as an actuating device. Control stick deflection informs the pilot that the automatic unit has cut in and indirectly indicates angle of attack.

Sometimes electromagnetic clutches and additional loading devices (torsion bars) are used as automatic actuating devices. In this instance forces on the control stick (Figure 3) increase abruptly when the automatic unit cuts in, making further increase in angle of attack difficult. In addition, it can be limited by reducing coefficient of transfer  $k_v$  from control stick to stabilizer (Figure 4). Decrease in  $k_v$  leads to a decrease in available angles of stabilizer deflection and correspondingly to a decrease in values of angle of attack into which the aircraft can be placed. We should note that these actuating devices are more passive than a plunger cylinder, since they impede exceeding allowable angle of attack but do not return the aircraft from a dangerous attitude.

These automatic devices substantially broaden the operating range of angles of attack and increase flight safety at maximum operating conditions. Therefore during intensive maneuvering a pilot should definitely switch on the appropriate automatic control. And when automatic limiters cut in, they should not be opposed or overridden, since this can lead to undesirable consequences.

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AVIATSIYA I KOSMONAVTIKA ON ARMS RACE, U.S. MILITARY THREAT

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 6, Jun 86 (signed to press 5 Jun 86) pp 30-31

[Article, published under the heading "At the Fronts of the Ideological Struggle," by Honored Cultural Worker RSFSR Col I. Filatov: "Two Approaches to the Same Problem"]

[Text] ...It is becoming increasingly obvious that intelligent solutions are not to be found through war -- neither international nor domestic solutions. The clash and struggle of opposite approaches to the prospects of world development have taken on a particularly complex character."

From the Proceedings of the 27th CPSU Congress

Assessing the present international situation, the 27th CPSU Congress stressed that the problem of war and peace is the most acute problem of the present day. Imperialism is threatening a third world war. It is placing the achievements of man's genius in the service of creating monstrous destructive force. The policy of imperialist circles, who are willing to sacrifice the destiny of entire peoples, is heightening the danger that these weapons may be brought into play. At the same time it has become even more obvious that nuclear war cannot serve as a means of resolving intergovernmental problems and disputes between different social systems. The unleashing of nuclear war in conditions of the present world military-strategic balance is tantamount to suicide for the aggressor himself. "Consequently, not only nuclear war proper but also preparations for such a war, that is, the arms race and the striving to achieve military superiority, cannot objectively bring political gain to anybody," it was stressed at the 27th CPSU Congress.

In spite of these generally-acknowledged conclusions, the reactionary forces of imperialism, and the United States in particular, have not given up their hopes for recouping social losses. They are counting on achieving military superiority over socialism by developing offensive space-based weapon systems, new weapons of mass destruction, and highly-accurate means of delivery. The United States, for example, is engaged in an intensive search for "acceptable" variations of wars on the earth and in space.

At the same time the mass media and the entire U.S. governmental ideological edifice are continuing to present reality in a distorted form, seeking to foist upon the U.S. public the notion of "Moscow's perfidy" and "response measures by Washington," and are seeking to justify the U.S. arms race. Following the Geneva summit meeting, the United States launched an anti-Soviet campaign with renewed energy.

In contrast to imperialism, which seeks to halt the advance of history by force and to return to the past, socialism has never of its own will linked its future with military solutions to international problems. Acting in the "spirit of Geneva," the Soviet Union, with the aim of ensuring a firm peace and security of peoples, has proposed an all-encompassing aggregate of measures which cut off all avenues to the arms race -- both in space and on earth, including nuclear, chemical, and conventional arms.

A large-scale, specific program of total and universal elimination of nuclear arms, tailored precisely to the times, proposed in a statement by CPSU Central Committee General Secretary Comrade M. S. Gorbachev on 15 January 1986, the first such proposal since the beginning of the nuclear age, has been greeted as a realistic way to bring the planet out of the impasse of confrontation and nuclear threat and has been given approval by the world community. It states a truly great aim -- to enter the third millennium without weapons of mass destruction, and of course prohibiting offensive space weapons, on the basis of mutually acceptable and rigorously-monitored agreements.

Our demand for the mandatory prohibiting of space weapons is quite understandable, for these weapons, being developed by the United States on the basis of the SDI Program, are intended not only for defense, as a "shield" against warheads, but also for attack. The U.S. press itself has frankly informed the world community on this score. Such SDI weapons as lasers can destroy not only enemy warheads but also individual targets on the earth, and even entire cities.

The USSR has on three different occasions extended its unilateral moratorium on nuclear test explosions and has proposed immediate assumption of talks on ceasing all nuclear testing. The Soviet side has advanced compromise proposals, seeking to accommodate the West, at conferences in Vienna and Stockholm. The USSR has proposed the mutual withdrawal of Soviet and U.S. naval forces from the Mediterranean.

The 27th CPSU Congress, ratifying these measures, advanced the basic points for establishing an all-encompassing system of international security.

The Soviet plan for guaranteeing the security of peoples and consolidating world peace demonstrates the ability of our party realistically and objectively to assess the processes taking place in the world and flexibly to respond to the demands of the moment. These include bold approaches, new political thinking, and an awareness of responsibility for the fate of peoples. The Soviet Union proposes that we enter the third millennium not with programs of "up-arming" and "Star Wars," but with substantial projects

involving the peaceful exploration and development of space by the resources of all mankind and a genuine guarantee of the security of peoples.

It is apparent from all indications, however, that the United States is unwilling to give up its armament plans, especially the "Star Wars" program. U.S. Secretary of State George Schultz has stated right out that the United States will continue with SDI and that no changes are anticipated in this position. "The priority emphasis we are giving to the 'Strategic Defense Initiative' is well known and remains entirely in force," he is seconded by the U.S. Secretary of Defense. President Reagan himself, while claiming to welcome Soviet peace initiatives, is taking no practical steps toward their support and implementation.

A conclusion suggests itself: by hindering solution to the problem of nonmilitarization of space, the present U.S. Administration has no desire to cease the arms race on earth, which is generating immense profits for the military-industrial complex, to the detriment of the security of peoples, including the American people. The SDI budget request for fiscal year 1987, for example, is 4.8 billion dollars -- almost twice as much as in the current fiscal year.

From the standpoint of military strategy, the United States is linking to implementation of the SDI program the illusory hope of launching with impunity a disarming attack on the USSR utilizing strategic nuclear weapons (the strategic triad) as well as weapons deployed in space. The United States is intensively engaged in nuclear testing toward this end, justifying its actions with the claim that fewer such tests have allegedly been conducted by the United States than by the USSR. In actuality, however, according to the figures of the Stockholm Institute on Problems of Peace, as of the beginning of 1985 the United States had detonated 772 nuclear explosions, while the USSR had detonated only 556. One should bear in mind thereby that the Soviet Union has not conducted any nuclear tests since 6 August 1985, while the United States has continued nuclear testing contrary to the will of peoples. The most recent tests must be viewed as a show of force challenging the Soviet Union and the entire world. And yet Washington proposes to us that not the prohibition of nuclear testing be "monitored" but rather the procedure of improving nuclear weapons.

The Pentagon is planning to bring into operational service by the end of the present decade 100 MX missiles carrying 1,000 nuclear warheads and 100 B-1B bombers each carrying a payload of 57 tons, capable of carrying up to 3,000 nuclear warheads on a single sortie. The first B-1Bs have already been delivered to Dyess Air Force Base (Texas). At the end of 1986 the first squadron of the new bombers will begin standing alert duty. In addition, work is continuing on development of the ATB ("Stealth") bomber. The Navy will take delivery on 5-6 "Ohio" class nuclear-powered fleet ballistic missile submarines, which in a single launch of Trident I and Trident II missiles can deliver approximately 1,200 warheads to their targets. The U.S. military will be taking delivery on several thousand long-range cruise missiles of various basing modes.

According to reports in the foreign press, the United States is proceeding at a priority pace with development of and equipping its forces with the newest highly-accurate conventional weapons, development of combined automated troop command and control systems at all levels, and reorganization of the armed forces in conformity with the Army-90 Program.

Under pressure applied by the United States, that country's NATO allies as well as Japan are picking up the pace of military preparations. Combat training of U.S. and NATO troops is taking on a clearly-marked anti-Soviet thrust, training based on the "airland operation" concept. This concept prescribes employment of all types of weapons to destroy targets over large areas, delivering strikes on the support echelons of Warsaw Pact forces, on airfields, lines of communication, command posts, and other facilities situated at a distance of 15-150 kilometers from the forward edge of the battle area in the combat zone, with the aim, as is stated in a new field manual, of "defeating the Soviet Union and its allies in case of a conflict in Europe."

The United States has adopted the so-called "aerospace doctrine." According to this doctrine, "the military should no longer make a distinction between the atmosphere, in which aircraft operate, and near-Earth space." Implementing this doctrine, the United States is carrying out an extensive program which calls for building military air superiority over the USSR. The U.S. Air Force plans to have 38 instead of 24 tactical air wings and more than 1,000 military transport aircraft in the near future.

A total of 28 B-52 strategic bombers, Tactical Air Command and Military Airlift Command units, strategic reconnaissance aircraft and AWACS long-range radar detection and control aircraft are being assigned to the interventionist rapid deployment forces. A new heavy military transport aircraft, the CX, is being developed for these forces.

Large-scale U.S. and NATO military exercises and maneuvers are of a clearly-marked anti-Soviet character. The quantity of forces and assets taking part in these activities is increasing. They are taking on an increasingly more provocative character and are being transformed into barefaced "saber rattling" directly along the borders of the USSR as well as other socialist and independent sovereign states.

The geography of the Pentagon's militaristic wargames is extremely broad. This year almost 5,000 U.S. military personnel were deployed to Honduras, where the Terencio Sierra 86 maneuvers were held close to the Nicaraguan border -- a rehearsal for a possible invasion by U.S.-Honduran troops into the Sandinista Republic.

As part of the Reforger exercise, the Pentagon transported from the United States to Western Europe approximately 20,000 military personnel and almost 300,000 tons of military equipment and supplies. The culmination point of these war games was a large-scale exercise held on the territory of the FRG in immediate proximity to the borders of Czechoslovakia and the GDR.

The large-scale Team Spirit 86 maneuvers were conducted in the East, involving tens of thousands of U.S. and South Korean military personnel. Recently the White House administration has been intensively engaged in developing the doctrine of "new globalism," which calls for direct U.S. interference in the domestic affairs of developing sovereign states. The concept of "low-intensity conflicts," such as the intervention in Grenada and acts of provocation against Nicaragua and other countries are one aspect of this doctrine.

Washington conducted a truly militaristic orgy off the coast of Libya, with a naval armada, including aircraft carriers, steaming into those waters. An attack was mounted against this country.

This is why, as regards preserving peace and saving mankind from the threat of nuclear annihilation, it was emphasized at the 27th CPSU Congress, today nobody can remain uninvolved. Every country, regardless of its sociopolitical system, must contribute to this cause.

At the talks on mutual reduction of forces and arms in Central Europe, the Western parties to the talks are generally receptive to the proposals by the socialist countries calling for initial reduction of Soviet and U.S. troops in combination with subsequently maintaining for a specified period of time the current NATO and Warsaw Pact force levels in this region. Response proposals by the NATO member countries, however, are in a number of aspects of a one-sided and unrealistic nature. In place of efforts to lower the level of military confrontation, they offer complicated monitoring proposals.

At the Stockholm Conference on strengthening confidence-building measures, security and disarmament in Europe, where there is a real possibility of reaching mutually acceptable solutions, the Western countries have been attempting to sidestep such an important issue as giving notice of air force and naval exercises, although the experience of history and that of modern conflicts indicates that air and naval forces are of great importance and frequently of determining significance in the conduct of combat operations.

Proposing a specific program of total, across-the-board elimination of nuclear weapons and advocating the nonmilitarization of space, the elimination of chemical weapons, and reduction of conventional arms and forces, the USSR is exposing the phony thesis of "Soviet military threat" peddled by the ideologues of imperialism. Resolute actions by the Soviet State in defense of peace and improving the overall international climate is not an indication of weakness but a manifestation of our consistent peace-seeking foreign policy, passed down to us by V. I. Lenin.

In the present conditions the Soviet State is constructing its foreign policy taking into account an aggregate of real factors. Addressing a meeting of workers in the city of Tolyatti, CPSU Central Committee General Secretary Comrade M. S. Gorbachev emphasized that we shall not allow ourselves to be caught napping. The Soviet State has proven repeatedly that it is capable of responding to any challenge. If it becomes necessary, it will respond in an adequate fashion this time as well. We do not seek greater security, as was noted at the 27th CPSU Congress, nor shall we accept less security.



Actively pursuing a policy of peace, the Soviet Union is ready and willing to engage in broad interaction with all those who adopt a position of intelligence and good will and acknowledgment of responsibility for securing the future of mankind -- without wars and without weapons. But as long as there exists the danger of unleashing of aggression by imperialism, military conflicts and various acts of provocation, the CPSU and Soviet Government consider it essential, states the CPSU Program, that the USSR Armed Forces remain at a level excluding the possibility of strategic superiority by the forces of imperialism, that the defense capability of the Soviet State improve across the board, and that the fighting alliance of the armies of the brother socialist countries become stronger.

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## DEFICIENCIES IN MILITARY AIR TRAFFIC CONTROL NOTED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 6, Jun 86 (signed to press 5 Jun 86) pp 32-33

[Article, published under the heading "For a High Degree of Flying Efficiency and Flight Safety," by staff flight operations officers Gds Lt Col Yu. Zvyagin: "An Error or Lack of Discipline?"]

[Text] The labor performed by the members of air traffic control teams (GRP) is critically important and difficult. By their competent, vigorous actions they maintain exemplary order on the ground and in the air and ensure on-schedule and high-quality performance of flight operations shift task assignments. Most of the members of the ATC team are experienced, highly-skilled aviation personnel. They vigilantly guard flight safety and respond swiftly and correctly to any emergency situation which arises. They are assisted by a high degree of proficiency, organization, and smooth coordination in their work.

At the same time practical experience indicates that some air mishap-threatening situations unfortunately still occur due to deficiencies in air traffic control. They are caused by faulty actions on the part of supervisor-level flight personnel enlisted to work in air traffic control and by an inability to evaluate a situation quickly and competently to make a decision promptly and to make sure that it is precisely carried.

...The flight operations shift was about over. Two aircraft were doing pattern work at 600 meters and flying at 600 km/h. A third aircraft, which had completed a weapons delivery sortie, was approaching the field at a speed of 800 km/h. Three aircraft were operating above the airfield in VFR conditions. It would seem that there was no indication of an imminent problem. Strange as it may seem, however, the tower controller, Sr Lt V. Lebedev, was unable correctly to assess the air situation and allowed two aircraft to come dangerously close to one another. The flight operations officer was forced to intervene.

Why did this violation of regulations occur?

"I made a mistake," the officer tried to make excuses. "It can happen to anybody."

An analysis of this near-mishap incident determined that Sr Lt V. Lebedev had failed to become properly briefed on the training activities during that flight operations shift and had failed to concentrate his attention primarily on precise airborne aircraft control procedures. In short, he had lost his feeling of responsibility for the assigned job. And at the critical moment he had essentially violated one of the most important requirements of regulations: a serviceman is obliged to possess firm knowledge of and skillfully and conscientiously to carry out his duties.

Unquestionably Sr Lt V. Lebedev was primarily responsible for the incident. But this does not mean that responsibility is lifted from those unit staff officers whose job it was to check his proficiency. Unfortunately they had failed to do so, assuming that the specialist personnel on the ATC team were sufficiently experienced.

One cannot state that there is no concern in the unit for the proficiency level of ATC crews. Considerable attention is devoted to this on days of preliminary preparation and at flight operations performance critique sessions. This work is not always specific and purposeful, however. And yet it is not enough to point out certain deficiencies and to call for them to be corrected. It is also necessary to suggest the path an aviation specialist should follow in order to rise to new and higher levels of job proficiency. Unfortunately this is not done. Is this not why instances of unsatisfactory air traffic control occur again and again?

The rapid evolution of aircraft equipment, increasing intensity of flight operations and greater complexity of the tasks performed by aviation personnel, as well as the very structure of flight operations control and supervision have led to a situation where at times the equipment is more reliable than the person operating it. During flight operations, for example, air traffic controllers carry a substantial and ever-increasing work load, which at certain moments reaches the limits of man's psychophysiological capabilities to perceive and process incoming information and to issue air traffic control instructions. In today's flight operations the man with the microphone is an operator of an extremely complex technical system. In order to control flight operations in a high-quality and effective manner, he must constantly keep track of the dynamics of the environment in which they are taking place, maintain a mental picture of the situation in regard to space and time, foresee the trend in the subsequent development of events, and have the ability quickly and surely to predict different variations of arising situations and prescribe in advance his actions in response to any of these possibilities.

Constant composure and the highest degree of alertness, connected with anticipation of increasing complexity of the air environment, are the companions of air traffic controllers in their activities. To some degree they play a positive role as a unique inner agency monitoring their actions. Ultimately, however, they have an emotionally and psychologically depressing effect, becoming one of the causes of mistakes. As a result of constant neuroemotional stress, for example (I know this from my own personal experience), by the end of the fourth hour of a flight operations shift there

is an appreciable decline in work efficiency, and it takes longer to make decisions.

Flight operations experience and research by specialists in aviation medicine indicate that work performance by an air traffic control team is sufficiently effective with a quite specific number of aircraft operating during a flight operations shift. If the number of aircraft aloft is greater, preconditions are present for mistakes. In 8-14 percent of instances, the ATC controller gives instructions without stating the pilot's callsign and without deeply scrutinizing the air situation. Precision suffers, and he fails to follow the book in giving instructions. These mistakes increase substantially during the fifth hour on the job. Sometimes things get so bad that in certain instances the terminal area controller, for example, due to excessive information loading, makes mistakes in issuing instructions at such critical points as assignment to a new altitude, passing off to another controller, etc.

One typical error on the part of a flight operations officer and other ATC controllers is loss of the overall picture of mutual location of aircraft in their zones of responsibility, which of course complicates the air situation. Once, for example, at the beginning of my breaking-in period as a staff flight operations officer, I cleared an aircraft to taxi out to the active. At this moment the telephone rang, and after that I had to speak over the public-address system: the drag chute had failed to deploy on one of the aircraft upon landing. At this moment an aircraft reported inbound to the outer compass locator. I switched on the floodlights and cleared him to land. At this point I suddenly realized that a metallic-skinned supersonic aircraft was standing motionless on the runway in the floodlight beams. Another aircraft was on final.... Naturally I sent him back around and took other measures to prevent an air mishap, but the mistake had been made.

I drew the following conclusion from the incident: a flight operations officer and other ATC controllers must have the ability at any given moment to extract the most important items from the general flow of various information, while retaining preceding information in their memory. In addition, it is important to organize mutual assistance among ATC controllers. If, for example, the tower controller has heard or noticed any mistake or incorrect instructions by the flight operations officer or terminal area controller, he should immediately step in and let them know, rather than remaining a passive observer of a dangerous situation. Experience indicates that the highest degree of coordination is achieved in regular, staff ATC teams.

Does the above discussion mean that it is impossible to avoid mistakes in air traffic control due to the "lack of perfection" of human nature? Of course not. There have been many cases where in emergency situations an ATC team has come to the aid of aircrews, preventing serious air accidents. These examples attest to the fact that the human organism contains considerable reserve potential. This potential must be revealed and coordinated with hardware capabilities in order to improve the quality and effectiveness of air traffic control.

One way to accomplish this task is a systems, combined approach to training air traffic controllers. To date we have virtually failed to consider the

"throughput capacity" of the person manning the microphone. But this is essential. Experience indicates, for example, that when an emergency situation occurs in the air, even when the pilot promptly reports this fact, the ATC controller is not always able to issue instructions in that very limited time a pilot has in an emergency situation. His first actions should precede instructions by the air traffic controller, the purpose of which is to help the pilot check the correctness of the procedures he is following, to correct mistakes, and in the final analysis to end the emergency situation. Situations occur which are not covered by the manual, and in order to give the pilot precisely those instructions required by the situation, it is necessary to possess consummate knowledge of the aircraft, to take direct part in flying the simulator, to introduce various equipment malfunctions in the process, and to practice giving precise and competent instructions.

Summarizing the above, one can state that the principal errors in actions by air traffic controllers which worsen an air situation are a result of poor organization of flight operations, complete or partial loss of knowledge of the situation in the various zones of responsibility, disruption of information exchange between controllers and aircrews, and controller unpreparedness to issue control instructions when an emergency situation arises during flight.

In many instances such mistakes can be avoided. I believe that this requires a unique engineering approach to the flight controller: his strength and reliability should be considered and ways found to increase this reliability. For example, flight operations should be scheduled taking into account changing work efficiency and psychological capabilities of ATC personnel during different hours of a flight operations shift, and combined practice sessions should be held for the flight operations officer and other ATC personnel, working on coordination and skills in mutual exchange of information.

It is also important to find the true causes of errors and mistakes in ATC control and direction of flight operations and to determine whether an error or lack of discipline is involved. This is essential in order to take preventive measures in a prompt and timely manner. In my view the main thing is to be up to the task of handling the most modern equipment we operate. There should be no mistakes in our job -- controlling aircrews in the air and on the ground.

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## IMPORTANCE OF POST-ACTION PERFORMANCE ANALYSIS

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 6, Jun 86 (signed to press 5 Jun 86) pp 33-34

[Article, published under the heading "From Experience in Accident-Free Flight Operations," by Military Pilot 1st Class Gds Maj V. Lebedev: "Performance Analysis Teaches"]

[Text] While making an approach in IFR weather, Gds Lt A. Remizov failed to hold to the glidepath and allowed his aircraft to yaw back and forth. As soon as the pilot taxied to the flight line, his flight commander walked up to his aircraft. The flight commander conducted a performance analysis between training sorties right on the spot, analyzed the pilot's mistakes, and suggested how to prevent them. A fine tradition has been established in this guards regiment: after each training flight the instructor, without postponing things until later, thoroughly analyzes a pilot's performance in the air, errors made in flying technique, miscues in the process of combat flying and weapons delivery, makes comments, and gives advice.

What is the value of this approach? I believe it lies in the following: when a flight and its dynamics are still fresh in a pilot's memory, he does a better job of grasping and remembering recommendations. And as a rule, when he implements recommendations he no longer experiences particular difficulties in the air and does not repeat the same mistake twice.

But things have not always been this way in our unit. In the past some flight commanders would conduct a pilot performance analysis in an excessively formalistic and insufficiently instructive manner. They apparently were placing greater weight on the preliminary and full post-flight critiques at the squadron and unit level. Of course they are very beneficial, since experienced commanders, the most proficient instructor pilots and the best methods experts, persons capable of thoroughly revealing the causes of errors and giving theoretically substantiated recommendations on preventing them, take part in analyzing faulty performance and mishap-threatening air situations. But nontypical errors by flight personnel frequently were not reflected at these critique and analysis sessions. It sometimes happened that due to the broad area covered, work with individual pilots would be neglected. And the flight commander would not become involved, although he, the pilot's immediate mentor, knows better than anybody else the strong and weak points of

a pilot's professional training and can substantiate deficiencies in a skilled and logical manner and explain in an understandable way how best to correct them in the current phase of training.

Flight data recorder tapes are very helpful in conducting a high-quality critique and analysis of flight operations. They make it possible not only to assess the degree to which a pilot has mastered a given navigation technique or maneuver but also, and this is particularly important, promptly to determine the slightest violation of safety regulations. The fact is that sometimes an inexperienced pilot, carried away by combat, unwittingly exceeds aircraft operating conditions. But the flight data recorders offer a complete picture of his actions, record even insignificant errors and, most important, help establish their cause.

For example, one of our young pilots made a number of errors while closing with the target. Nevertheless he tried to argue that everything had been within normal limits. But after they had interpreted the flight data recorder tape, he discovered with amazement that he had failed to maintain some of the attack parameters. And the flight commander subsequently also determined the reason for this error: insufficiently honed skills in distributing and switching attention.

Practical attention indicates that one and the same flying error can have the most diverse causes. But the instructor's method skill consists precisely in digging down to the basic cause in the course of the performance critique and analysis -- of all possible causes isolating that one which led to the error, for this in large measure determines success in training the combat pilot, quality of flying and flight safety.

One becomes even more strongly convinced of this upon analyzing the development of young pilots. For example, once considerable time passed between flights for Gds Sr Lt V. Nikishin. This officer regained his lost skills fairly rapidly, and on his very first flight did a good job of planning and executing an approach at weather minimums. But the next time up, flown "under the hood," he felt constrained, as a result of which he was rather jerky with the control stick. What was the problem? The instructor quite correctly saw that the cause was the pilot's excessive tenseness, a consequence of insufficient psychological conditioning. He held additional training sessions with him, as well as sessions on the simulator, and endeavored to instill self-confidence in the combat pilot. As a result Nikishin strengthened the requisite moral-volitional qualities and successfully passed the tests for the next higher proficiency rating. In due course he was promoted to 2nd class.

Practical flying experience as well as the experience of older comrades teaches one that at performance critique and analysis sessions one should not stress only mistakes and errors of omission. Figuratively speaking, this can clip a pilot's wings, especially a young pilot. Then he will perform in the air with constrained responses, afraid something will go wrong, and may even tend toward unnecessary simplifications in flying technique, in choosing and employing tactics. Our instructors are unquestionably correct when, in

addition to deficiencies, they always note positive points in the performance of combat pilots.

At a tactical air exercise a two-aircraft element led by Gds Capt A. Lyubushkin found itself in a difficult situation. Numerically superior "aggressor" forces were headed toward a defended installation. The adversary was aggressively maneuvering and jamming. In these conditions it was difficult to use the aircraft's radar sight. The fighter pilots succeeded in visually spotting the targets, however, and successfully attacked them head-on.

In summarizing the results of the tactical air exercise, the squadron commander noted the element leader's tactical sharpness. Lyubushkin had intelligently combined elements of defensive with offensive air-to-air combat, due to which he was able at any moment to avoid "aggressor" fire, for in combat skillful defense is just as important as effective attack.

The squadron commander, conducting the performance critique and analysis with flight personnel, organized it in conformity with the method developed in our outfit: he analyzed in detail specific tactical air exercise situations, persuasively showed the effectiveness of the tactics employed by the fighter element, explained why the pilots had proceeded this way and not differently, and theoretically validated their decisions. This approach to assessing airmen's combat activeness and proficiency proves effective, motivates innovation, and prepares the men for high-quality performance of combat training missions.

I should like to place particular emphasis on the following: in order for a post-action performance analysis to be effective and fully accomplish the stated goal, it is necessary thoroughly to know and take into account a pilot's personal qualities. For example, if an experienced pilot made an error, greater demandingness must be imposed on him, with strict monitoring of the procedure of task performance. It is a different matter altogether when the pilot is young and inexperienced. Here it is important to help, teach, and suggest. All forms of the training and indoctrination process are mobilized for this: training classes, simulator sessions, and check rides. Mutual assistance and exchange of advanced know-how are important in this area.

While teaching the young pilots, the instructors are of course also themselves learning -- they exchange opinions on the proficiency of their charges and confer on how to help them better get past bottlenecks in flight training and study of theory. They organize their work on the basis of recommendations drawn up by the regimental methods council. If necessary they enlist the squadron's experts in flying technique and combat flying for this.

It is for good reason that post-flight critique and analysis sessions are called genuine lessons in professional improvement. Conducted at a high organizational and methodological level, they help us wage an implacable



campaign against any and all deviations from the requirements of the documents which govern flight operations and help us in successfully meeting the pledges adopted by the military collective in the year of the 27th CPSU Congress.

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## IMPORTANCE OF ADEQUATE SLEEP FOR PILOTS

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 6, Jun 86 (signed to press 5 Jun 86) pp 34-35

[Article, published under the heading "Your Health," by Doctor of Medical Sciences Col Med Serv L. Grimak: "Sleep and Pilot Work Fitness"]

[Text] Modern aircraft require of crew members a high level of work fitness and efficiency and the ability to withstand extreme work and stress loads. Development of psychological stability in the pilot and navigator to various factors of flight is one of the basic components of their professional training.

As studies indicate, a high level of psychological resistance to extreme factors involved in flight depends on an individual's overall level of knowledgeability, mental and emotional makeup. It consists of knowledge and abilities which make it possible to construct correct interrelationships with those around them, to overcome conflict situations in a reasonable manner, and to control their own mood and state.

Forming of habits of mental self-organization of a full-valued night's sleep is a partial but very important aspect of this problem. This issue has been brought up for good reason. Specialists in aviation medicine noted long ago that sleep directly affects the quality of performance of flight assignments. A group of 80 young pilots, average age 27.7 years, average flying experience 8.4 years, and 40 veteran combat pilots, average age 39.3, and average flying experience 19 years, took part in a psychological questionnaire survey of flight personnel. The results indicated that more than 96 percent of the young pilots and approximately 92 percent of the veteran pilots had experienced sporadic instances of disturbed sleep just prior to flight operations. The forms of disturbance of sleep are summarized in Table 1.

The results show that difficulty in falling asleep, which sometimes may assume the character of insomnia, is most frequently encountered. The most important thing is the fact that, while aware of the negative effect of disturbance of sleep on one's feeling of well-being and one's work fitness and efficiency, most pilots do not realize that this is a result of failure to observe elementary rules of sleep psychohygiene.

Table 1. Forms of Disturbance of Sleep Experienced by Pilots Just Prior to Flight Operations\*

Nature of Disturbance of Sleep	Young Pilots	Veteran Pilots	Average
Difficulty falling asleep	48.7	53.5	47.5
Uneasy sleep	27.5	30.3	29.1
Premature awakening	25.0	34.5	28.3
Numerous dreams	17.2	17.8	16.6

\* The fact that the total exceeds 100 percent is because several forms of disturbance of sleep occur in the same person at different times.

Many scientific theories have viewed sleep as rest by brain cells which have become fatigued during waking hours. Detailed studies have established a paradoxical fact, however: brain cell activity during sleep is just as high as during strenuous activity while awake. Subsequently two phases of sleep were identified. Experts designated them "slow" and "fast" sleep. Not because they reflect the rate of any processes, but purely formally, proceeding from the external form of recorded brain biocurrents in the corresponding phases. Vigorous recovery of the organism's exchange processes takes place in the "slow" sleep phase. There also occurs during this phase processing of information which the subject perceived while awake and taking into account the tasks he is to perform upon awaking. The "fast" sleep phase can be viewed as a kind of "working" tuning of the organism for specific imminent activity and testing of the functional coordination of systems.

It is important to know that the dominant stimulation focus, based on the mental image of activity anticipated upon awakening, is the triggering and organizing mechanism for execution of all these processes. The more critical this activity is, the more pronounced the dominant stimulation. Psychologically this is manifested in the fact that just before falling asleep a person thinks through different variations of performance of imminent tasks, evaluates the quality of performance of preparatory stages, etc. Frequently a so-called "mental merry-go-round" also occurs, when analysis of possible variations of activity can run on infinitely. Insomnia may occur in such a case.

Studies also show that flight personnel indicate impending difficult and important flights as the most frequent cause of disturbance of sleep (see Table 2). This is particularly typical of pilots in the older group, in whom the dominant which forms the working state is not always successfully overcome by sleep inhibition as is the case with the younger pilots. A certain percentage of combat pilots resorts to soporifics to facilitate falling asleep. This practice should not be followed, since most soporifics depress the function of the central nervous system and thus reduce the level of psychological and emotional preparedness for the impending work.

Studies have indicated that not only flight surgeons but also instructors, commanders at all levels, and political workers should deal with matters of psychohygiene of flying labor, and psychohygiene of sleep in particular.

Particularly since purely medical aspects of disturbance of sleep (desynchronosis, flight fatigue) occupy an extremely modest place on the list of factors connected with the specific features of flying labor. The job-related factor is of determining significance in the occurrence of disturbance of sleep.

Table 2. Percentage Breakdown of Causes of Difficulty in Falling Asleep

Causes	Young Pilots	Veteran Pilots	Average
Impending difficult sorties	26.2	45.8	33.3
Mastering new equipment	22.5	17.8	20.0
Transition training to new aircraft	8.7	11.8	9.1
Fatigue from preceding sorties	7.5	-	5.0
Desynchronosis	6.2	-	4.1
Unpleasantnesses at work	2.5	5.9	3.3
Unpleasantnesses at home	8.7	10.0	8.3

Let us now turn to Table 3. As we can see, each number represents a given aspect of methodological, psychological or medical "shortfall" with flight personnel.

Table 3. Manifestation of Job-Related Causes of Disturbance of Pilot Sleep (percentages)

Causes	Young Pilots	Veteran Pilots	Average
Desire to prove one's ability	17.5	7.5	14.2
Desire to prove something to somebody	10.0	17.2	12.5
Doubts about quality of preparation	10.0	14.2	10.0
Extended periods on the ground between flying	-	2.5	0.8
Doubts about one's health	5.0	5.0	5.0
Fear of a specific factor of flight (G loads, disorientation, etc)	7.5	7.7	7.5
Unaccountable nervousness	12.5	16.6	15.5
Other	12.5	22.5	16.6

The list of causes of disturbance of sleep presented here also indicates those specific areas of daily work activity which should be included in a system of psychological preparation of a pilot for a flight. This gives reason to maintain that matters pertaining to pilot self-organization of sleep require constant close attention both by flight surgeons and commanders. One must bear in mind that sleep is not a forced loss of time but rather a phase of organization of information and physiological "improvement" of working form which is essential to the organism. And just as all phases of flight training, it should become a consciously controllable process, rather than being dependent on chance and transient circumstances. I believe that acquainting pilots in detail with current views on the role of sleep in vital

activity of the organism can serve as a basis for such a reworking of views. Banning the taking of soporifics on the eve of flight operations should definitely be compensated for with essential knowledge and mastery of elementary skills which make falling asleep a controllable process.

Today many pilots have mastered autogenous practice sessions well. This kind of practice drill encompasses methods of organizing one's consciousness which make it possible to fall asleep quickly and soundly at any time of the day or night and in any situation. For those who are not yet acquainted with this system we shall point out the principal elements which normalize the process of falling asleep.

First of all it is necessary to develop a firm habit of not solving problems when lying in bed. Going to bed should be preceded by a complete, precise understanding of tasks which are to be performed upon awakening. It is sometimes useful to formulate them on paper in order to become more sure of this. Immediately prior to falling asleep, however, these tasks should be mentally pictured only in a general form, with knowledge that the sleeping brain will definitely do an optimal job of preparing to perform them. This trust in the organism eliminates psychological and emotional tensions, while the "work" of the dominant, as discussed above, is transferred to the subconscious and thus does not hinder the onset of sleep.

In order to prevent an impending task from resurfacing, there exist in the consciousness several methods of "blocking" it in the subconscious. The simplest and most reliable of these methods is to learn to concentrate one's mind's eye with persistence on "examining" any highly simple emotionally neutral object. Experts claim that the most suitable object is a blue vase, a glass of water, or something of this nature. Two additional conditions of a purely physical nature help one fall asleep. The first condition is the most complete and sustained relaxation of the muscles. The second is establishment of a mode of breathing in which the duration of breathing out should exceed the time of breathing in. This does not require special practice sessions, merely monitoring of awareness.

Night sleep is far from being passive rest. It constitutes highly stressful and diversified work by the organism to prepare for impending activity. We should add that there occurs during sleep continuous regeneration of all functional systems and organs to their normal state. This is why disturbance of sleep sooner or later leads to development of various ailments. And yet some pilots still have an erroneously slighting attitude toward the quality of sleep. This is unfortunate. It is without question incompatible with high demands on psychophysiological tolerance of the factors connected with flying modern aircraft.

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#### PITFALLS OF PREMATURE LEARNING OF SECOND OCCUPATIONAL SPECIALTY REVEALED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 6, Jun 86 (signed to press 5 Jun 86) pp 36-37

[Article, published under the heading "For a High Degree of Combat Readiness," by Maj A. Zhilin: "Eagerly. But Is It Not Premature?"]

[Text] In aviation it has long been held that the mastery of related occupational specialties is of self-evident value. The greater the degree to which a technician or mechanic has mastered them, the faster and better quality of readying aircraft for flight operations and the greater a subunit's combat readiness. In general this is indeed the case. One can cite many examples where at tactical air exercises airmen who have mastered related occupational specialties successfully accomplish very difficult tasks in field conditions. As they say, the result is right there, plain as day.

As practical experience indicates, however, there are also negative phenomena in this important area. I recall a conversation with a young technician, Lt V. Fastov.

"In our squadron they are too eager for the men to master adjacent occupational specialties," the officer said. "You have the impression that they want to make all the technicians and mechanics a jack-of-all trades. But why should I, for example, now start learning to mount bombs, when I barely have time to handle my own job duties and lack experience and know-how? My diploma states that I am an electronics service technician, and this means that I should work primarily in this area."

I must state frankly that at first I thought that this officer simply failed to understand why a good deal of work was being done in the subunit on mastering adjacent occupational specialties. I recalled how the men of this subunit had performed at a very recent tactical air exercise. Personnel were carrying out a mock combat mission at a field airstrip. An engine component failed on one of the aircraft as the exercise was in full swing. It was necessary immediately to remove the engine. The small group of technical maintenance unit specialists on the spot was unable to handle the job with their own manpower.

Technicians and mechanics who had acquired skills in working with engine equipment and systems in the course of mastering related occupational specialties helped save the day. Capt M. Grishin, Sr Lt A. Krylov, and WOs V. Sharikov and I. Tugin directed the most critical areas. And squadron aviation personnel officers S. Martynov and A. Pashkov and WOs N. Smirnov and V. Zorin performed auxiliary operations under their supervision. Thus the commanding officer's order was carried out on time thanks to the thorough training and smooth coordination on the part of engineer and technician personnel.

"I realize that it is necessary to master a related occupational specialty," states Lieutenant Fastov. "But obviously after one has thoroughly mastered one's own job. Here is my point. Why is it that I, who have not yet mastered my technician's job, am taken away from my principal work, thus hindering me from mastering the finer details of my occupational specialty?"

This made me want to inquire further as to how aviation personnel in fact learn related occupational specialties. It became clear from conversations with specialist personnel, servicing group chiefs, and command personnel that there are substantial gaps in this area, and in certain instances things are taken to extremes.

Frankly, a somewhat less than sparkling picture took shape. A young technician or mechanic would be assigned to the squadron, for example, and would not yet have properly mastered his principal job, and even would not yet have earned a proficiency rating, when an engineer or group chief would begin dragging this individual to one or even several adjacent occupational specialties. During the breaking-in period the newcomer literally does not know which way to turn, scatters his time and energy, with no idea of what is the main thing for him. Trying to encompass everything at the same time, he inevitably has gaps in his knowledge and acquires superficial skills, which in the final analysis has a fatal effect on performance of his direct job duties. And this in turn affects the quality of aircraft preparation and flight safety.

It was ascertained that even the panels which give proficiency rating examinations are guilty of unnecessary relaxation of demands in this matter. Figuratively speaking, they sometimes simply shut their eyes to poor knowledge and skills on the part of technicians and mechanics. And yet the proficiency rating is an indicator of expertise and level of job proficiency. We have the situation where certain technicians and mechanics appear on paper as broad-profile specialists. And in actual fact? Put in simple terms, higher headquarters is deluded regarding the actual state of affairs in a given subunit.

Here is an example. Aircraft armament mechanic V. Benyukh, while readying systems for another sortie, did a poor job of plugging an electrical connector to a rocket pod. If his work had not been checked by a senior supervisor, the pilot would have been unable to accomplish his training mission at the range. We should note that Benyukh made this mistake only due to an inadequate level of training. The fact is that, when he reported to the squadron several months back from a training subunit, had been considered a fully-trained armament specialist. Without properly checking his knowledge and skills,

group chief Sr Lt V. Seleznyuk submitted him as a candidate for mastering an adjacent occupational specialty -- instrument technician. Subsequent events gave an answer to the question of whether this was appropriate for the young mechanic, since he lacked a proper theoretical and practical foundation.

Here is another example. Airframe and powerplant mechanic Jr Sgt N. Trikolenko began to be instructed in servicing avionics. One might ask why. After all, it would have been much easier for him to master the procedures of mounting bombs and installing the drag chute, that is, jobs which are simpler and closer to the specific features of his principal work area. Success would be highly likely in such an instance.

Why is it that such finer points are ignored in some subunits? There are several reasons for this. In particular, I ascertained from conversations with flight technical maintenance unit chiefs and squadron deputy commanders for aviation engineer service that at the beginning of the training year, when the men are making socialist pledges, instructions come from higher headquarters on how many excellent-rated individuals in combat and political training are to be developed, how many excellent-rated aircraft and proficiency-rated specialists there are to be, etc. This instruction circular also states that aviation personnel are to cross-train to other occupational specialties. I should state at the outset that this document contains nothing in common with imposition of will from higher in the chain of command, as some people attempt to portray it. By presenting approximate, let me emphasize the word approximate, figures, higher headquarters is pointing out to the subunits those performance levels which should be taken as goals in the process of combat training. But the squadron commanders and their deputies for aviation engineer service have the final say, making the final decision on the basis of specific conditions and the actual capabilities of the collectives they lead. In any case that is the way it should be.

In actual fact things happen differently. Certain officer-supervisors, not wanting to burden themselves with an analysis of the outfit's actual capabilities, and sometimes simply afraid of giving an unfavorable impression to their superiors, accept such figures as orders and endeavor to achieve the figures by hook or by crook. Such "efficiency" leads to a situation where mere lip service is given to some pledges, which are doomed to failure at the very outset.

As an illustration, service group chiefs and flight technical maintenance unit chiefs are assigned the task of having a specific number of men cross-trained in other military occupational specialties. A demand made without considering realistic capabilities for accomplishment invariably causes last-minute rush work, forcing of events, and excessive attention to form with consequent detriment to content, which does not have the best effect on quality of training of specialist personnel.

The people in the units know this. Supervisor personnel engaged in teaching adjacent-area occupational specialties to the men, however, continue to rote-drill their subordinates. Why is this? I believe that it is because some of them are concerned not so much about the quality of this training as the impression to be produced by the report on work accomplished. Thus as a



result of implementation of the principle of "the important thing is to make our superiors happy," a dangerous ailment arises, called deception.

The CPSU Central Committee Political Report to the 27th CPSU Congress notes that no reorganization or breakthrough can occur if each and every Communist, especially leader personnel, does not comprehend the enormous significance of practical actions, which are the only things which can move life forward. This same document points to the need to declare a determined and ruthless war against bureaucracy. Vladimir Ilich Lenin considered it particularly important to combat it at turning-point moments, during transition from one system of management to another, when a maximum of efficiency, speed and energy are required. Today bureaucracy is a serious obstacle on the path of forward movement. One must be concerned about this matter. It demands conclusions. It is important here to bear in mind that bureaucratic distortions are manifested first and foremost more strongly wherever there is lacking businesslike efficiency, publicity, verification from below, and where one is not strictly held to account for the assigned task.

Apparently such distortions occur also because a uniform system of cross-training in adjacent military occupational specialties has to date not been developed in the units. Responsibility for this work is borne by subunit supervisor personnel, and its effectiveness, its planned and orderly nature depend first and foremost on their initiative and imagination.

It is obviously high time to think about spelling out the most important items pertaining to aviation personnel mastering adjacent-area occupational specialties with an appropriate regulation, which would concretely specify initial data and end results. Then it will become clear where to start the job and how to organize it in the process of daily training.

Those shortcomings mentioned here are infrequently encountered in aviation units and are for the most part an annoying exception to the general rule. But since they do occur, they must be discussed, and they must be combated. In addition it is very important skillfully and extensively to disseminate the experience and know-how of vanguard collectives. And one need not go far afield to find them.

In the squadron in which officer L. Degtyarenko serves as commander for aviation engineer service, for example, more than 80 percent of aviation engineer service personnel have mastered adjacent-area occupational specialties. Quite frankly, this is an impressive figure. At first glance it might seem that it is far from objective. These doubts are put to rest, however, when one observes the actions of aviation personnel during a tactical air exercise. A high degree of interchangeability has been achieved in the flights, servicing groups, and aircrews. Aircraft equipment specialist WO M. Smirnov, for example, does a quick and precise job of handling the duties of airframe and powerplant mechanic, while technician Sr Lt Yu. Korotkov skillfully mounts bombs and loads pods with rockets.

The technical personnel of the flight led by Master Proficiency-Rated Capt S. Markov has achieved good results in combat proficiency improvement. All aviation personnel in this flight are highly proficiency-rated specialists.

Due to the fact that every technician and mechanic in the flight has mastered one adjacent-area job, while Sr Lt S. Yakovlev and WOs N. Sorokin and S. Svetlov have mastered several related-area specialties, technician personnel are capable of rapidly readying their aircraft for action.

This is an example of a thoughtful, innovative attitude toward this task and something for other collectives to emulate.

How has the squadron achieved such results?

"The attained results were preceded by hard, painstaking work," stated officer Degtyarenko. "It is the result of labor not of a day or a month. Several years ago we had only 3 specialist personnel who had solidly mastered adjacent-area occupational specialties. Quite frankly, the authorities were giving us a hard time during that period. We heard all kinds of complaints! Nevertheless we did not follow the path of least resistance and did not force the pace of cross-training in adjacent areas of specialization at the expense of the quality of the men's knowledge and skills, nor did we chase after phantom figures. A special training schedule was drawn up in the squadron, on the basis of which classes on theory and practical training sessions were conducted with engineer-technician personnel. It became a rule in our collective that only proficiency-rated personnel were to be enlisted to work on mastering adjacent-area occupational specialties. In addition, in planning, so to speak, an additional occupational specialty for a given technician or mechanic, we endeavored to take into consideration its proximity to his principal specialty. For example, an airframe and powerplant technician masters weapons specialization faster, while it is easier for an aircraft equipment mechanic to learn electronic systems."

As Degtyarenko noted, however, this principle is not always adhered to in the subunit. For example, if an individual expresses the desire to study any other occupational specialty, this is the determining factor. In such a case the supervisor's job is to offer him maximum help and support in a prompt and timely manner in accomplishing his goal. Young technicians lacking proficiency ratings have just joined the outfit. Veteran aviation personnel Capts Yu. Morozov and V. Soyev, and Sr Lts N. Maslov and N. Demin are training them to pass their proficiency rating examinations. They will also help their charges next year master adjacent-area occupational specialties. Thus all technician personnel will be capable of readying aircraft in several specialization areas.

As is evident from the practical experience of vanguard subunits, with a thoughtful approach to such an important business as mastering adjacent-area occupational specialties, there are fewer outlays in morale and material terms, training time is saved, and specialist personnel labor is more efficient. This is achieved wherever people do not hasten to surround themselves with a palisade of phantom numbers, where the end result is directly tied in with a high degree of combat readiness. Therefore I believe that before recommending that a specialist master new job duties, one might well ask the question whether he is ready for this at the given moment. Would it not be better if a subordinate first becomes a genuine professional at his own job, and then later proceeds to learn another occupational specialty?

The question of efficiency was discussed at the 27th CPSU Congress. It was noted that this is a subject of solid importance. Any disharmony between word and deed cannot be tolerated in any form whatsoever. This should be borne in mind by every supervisor and every party member, for performed work is generally judged by agreement between word and deed.

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## PROBLEMS OF INDOCTRINATION BY PUNISHMENT

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[Article, published under the heading "The Army's Strength Lies in Discipline," by Sr Lt V. Shevchenko, flight technical maintenance unit chief: "After Punishment...."]

[Text] Flight technical maintenance unit chief Sr Lt V. Orlovets was upset as he left the office of the squadron deputy commander for aviation engineer service. "Fate has brought me a subordinate who causes nothing but problems," he angrily said to himself about Lt I. Chernyakov. "I have put him on report three times, with no result. What can be done about him?"

Senior Lieutenant Orlovets's state of mind at that moment was understandable. Who likes to hear complaints from one's superior almost every day? And for what? For mistakes made by a subordinate! Therefore following his conversation with the engineer, the flight technical maintenance unit chief, following the principle of "he gets what he deserves," issued another reprimand to the aircraft technician.

At first glance this would seem to be quite logical. But let us take a look at the situation from the inside, so to speak, assessing it from a moral and psychological standpoint. As we know, penalties are imposed for the purpose of having an educational effect on a person. But what influence was exerted on Lieutenant Chernyakov by four reprimands in ...three months? Did they have any substantial indoctrinational effect? Hardly likely. Rather the opposite. At this point it makes sense to return to the beginning, to the initial stages of development of the young officer as an aircraft technician.

Lt I. Chernyakov was assigned to active duty with the squadron from reserve status after graduating from a civilian higher educational institution. As is usually the case, he passed the qualification tests, was assigned an aircraft, and proceeded to go to work. Naturally he encountered objective difficulties at first. A great deal was new and unaccustomed: the strict daily regimen, the military demandingness of his superiors, and the specific features of the aircraft technician's job, which involves considerable exertion of physical and emotional energy. This officer made some mistakes due to inexperience, and he had somewhat less than full composure. It was precisely at that time

that he should have been given support and taught how to work as is required by aviation engineer service regulations. But instead of this, the young officer was given his first reprimand for errors of omission in readying his aircraft. Quite frankly, this beginning of his active duty had a discouraging effect on the lieutenant. He literally did not know where to begin. His flustered attitude, however, only aggravated the situation, and his subsequent reprimands hit him even harder.

I do not propose to predict how Lieutenant Chernyakov's career would have progressed if he had remained in Sr Lt V. Orlovets's flight. But he was transferred to the subunit headed by Capt S. Shestachenko. Criticism of the young technician ceased immediately. A strange metamorphosis, it would seem. In actual fact there is nothing unusual about it.

Capt S. Shestachenko, an experienced specialist and skilled methods expert, follows the rule of teaching a subordinate how to do his job before demanding absolute and precise, to-the-letter performance of his job duties. This officer is firmly convinced that a person does not begin successfully performing an assigned task until he clearly understands what is required of him. From the very first day the flight technical maintenance unit chief would patiently explain to Lieutenant Chernyakov the manner and procedure of performing process operations and calmly teach him to observe regulations -- the foundation of military service. Kindness and consideration on the part of his superior constituted that fertile soil on which healthy shoots abundantly sprouted. Chernyakov cheered up and began performing his duties with greater zeal. And, most important, he developed a keen interest in his job. This officer is now confident about his job and is preparing to take proficiency rating exams.

Indoctrination of subordinates is a complex and critical process. Everybody who is involved in this process in one way or another is aware of this and has a great deal to say about it. Nevertheless one still frequently encounters a less than serious attitude toward it. Why is this? I believe that it is primarily because sometimes officers who have not had previous experience working with others, who have failed to display the requisite organizer and educator qualities, or who are simply untrained in this important area, are sometimes promoted to supervisory positions.

Take, for example, assignment to the position of flight technical maintenance unit chief. As a rule specialist technical training is considered the determining criterion here. There is no argument that a flight technical maintenance unit chief should possess consummate knowledge of the aircraft. Is this sufficient, however, in order successfully to carry out his job-related duties? Practical experience convinces us that the flight technical maintenance unit chief is not only a technical specialist but also a leader and organizer of the training process. This means that he should possess skills in indoctrinating others, which are acquired in the course of specialized classes and in practical experience. Only technical training classes are conducted as a rule in the subunits, however, while there is no time available for the fundamentals of military education science and psychology. And to be quite frank, the problem here is not a lack of instruction time but the fact that at the present time nobody is giving

serious thought to this matter. Therefore newly-appointed supervisors must set up the indoctrinational process on the basis of their own notions.

Apparently this is also the reason why one should not be surprised at the fact that some lower-echelon supervisors try to solve the problem of training and indoctrination with shouting or punishment, practically considering this to be a remedy for all ills. As I see it, another reason for the peculiar one-sidedness in indoctrination of subordinates is the fact that these supervisory personnel have not been taught to make proper use of their authority to reward and punish. I shall cite an example.

Sr Lt S. Koruchnikov had committed a gross violation of military discipline. Aircraft armament group chief Sr Lt Ya. Dychkov put him on report. Some time later Koruchnikov again broke regulations, and was again punished. When this officer committed still another violation a month later, the subunit authorities decided to examine the matter in order to determine why he was regularly committing breaches of military discipline.

Sr Lt S. Koruchnikov was a well-trained specialist, but there were serious flaws in his personal discipline. This officer had a casual attitude toward his own conduct not only off but on duty as well: he would be late to formation, argue with his superiors, and act rude and haughty to his fellow servicemen. We must state that this airman's misdeeds did not go unpunished. Nevertheless this had practically no effect on his behavior. What was the problem?

It was ascertained that aircraft armament group chief Sr Lt Ya. Dychkov organized the entire indoctrination process essentially on the basis of administrative influence on his subordinates. A misstep results in punishment, and a second breach of discipline brings additional punishment. On the one hand this supervisor's firm position merits approval: no breach of regulations should be ignored. On the other hand, however, one is quite right in asking the following question: but what other indoctrinational measures were taken with his subordinate during the period between punishments, and how was preventive work organized? This is an important point. It was ascertained that no daily indoctrination work was being conducted in the group. Senior Lieutenant Dychkov gave the following explanation: "I am not a nursemaid; it is not my job to persuade and cajole. I've got plenty to do in my job without this; the main thing is for the equipment to be in proper operating condition."

Yes, the equipment should always be ready for action. But equipment combat readiness is provided by people. And is indoctrination of subordinates not a job duty of command personnel? How can one fail to notice the human soul which, figuratively speaking, also sometimes requires preventive measures, for in the final analysis aircraft operating condition and working efficiency depends, if I may use the expression, on the human operator's ideological-moral "proper working order," on his decency and sense of responsibility. This means that indoctrination work with individuals should be emphasized. In my opinion precisely this forms the foundation which guarantees continuing overall success.

In the CPSU Central Committee Political Report to the 27th CPSU Congress, CPSU Central Committee General Secretary Mikhail Sergeyevich Gorbachev called work with individuals a most important form of indoctrination: "One cannot say that no attention is being devoted to this, but the customary 'gross output' approach is a serious hindrance in the ideological area as well. The figures here are truly impressive. Tens and hundreds of thousands of propagandists, agitators, political briefers, study groups and seminars, newspapers and magazines coming out in millions of copies, and millions of people attending lectures. All this is fine. But does the living, breathing individual not disappear in this welter of figures and 'encompassments'?"

I feel that these words contain great meaning: there should be no short-lived campaigning in indoctrination work. A well thought-out, businesslike, specific approach is needed. In practice, however, this is not always attained. Sometimes only measures of a general nature are organized in the subunits. Naturally it is easier to present a lecture to all personnel on off-duty standards of conduct, for example, than to exert specific influence on an individual and to persuade him to change his mind about something. But does this entitle a person to follow the path of least resistance? I am convinced that no general lecture or talk can substitute for a lively, serious, frank conversation between superior and subordinate about important problems.

Experience convinces me that one can manage and direct the indoctrinational process in a reliable manner only if the appropriate instruments are used. In particular, what is needed is a well-conceived method of analyzing the effectiveness of disciplinary measures. In the vanguard outfits they gather data for this purpose, based on each month's performance results, on who commended and punished subordinates and for what. Instances of repeat punishments are particularly carefully recorded. This makes it possible to take appropriate measures in a prompt manner.

I should like to mention one more thing. For some unknown reasons young officers are rarely enlisted into indoctrination work. In my opinion this is wrong. They need to establish their authority from the very first day and to gain teaching experience. I feel that instruction methods training conferences and classes on theory and practical matters should be held with young officers on a regular basis, and those who display passivity in working with subordinates should be held more strictly to account.

Indoctrination is an innovative matter. It does not have universal devices which apply to all instances one encounters, but requires constant search and the ability to keep pace with the times. It was noted at the 27th CPSU Congress that raising the degree of maturity of society and building communism means steadily increasing the maturity of man's consciousness. This is why every supervisor, regardless of the position he holds, should ask the following question before punishing or commending a subordinate: what indoctrinational effect does this decision have?

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## AIRCRAFT WITH VECTORED-THRUST ENGINES ANALYZED

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[Article, published under the heading "Weapons of Aggression and Brigandage," by Doctor of Technical Sciences Col A. Nelyubov: "Vectored-Thrust Aircraft"; based on materials published in the foreign press]

[Text] A number of aggressive NATO bloc member nations are equipped with Harrier subsonic V/STOL aircraft. Work is continuing on upgrading them, including an improved Pegasus engine with thrust-vectoring exhaust nozzles. The British Royal Air Force, for example, flies the GR.3 Harrier. In addition, experimental models of the GR.5, to be flown by the Royal Navy, are being built.

The U.S. Navy flies AV-8A aircraft. Tests of the AV-8B modified Harrier have been completed. Foreign experts believe that the U.S. Navy will soon take delivery on these aircraft. Reports have appeared in the foreign press that another version of the Harrier, the TAV-8B, has been developed. Specialists state that subsonic Harrier aircraft (GR.3 and AV-8A) took part in the Anglo-Argentine conflict. They operated as ground-attack aircraft against ground and naval surface targets, while they were employed as fighters to down enemy aircraft with guided missiles and machinegun-cannon armament.

The foreign press notes that research and development activities are presently in full swing, working on development of supersonic aircraft powered by vectored-thrust engines. It was reported in the foreign press, for example, that supersonic short takeoff and vertical landing (STVL) aircraft have been designed in Great Britain, although it was emphasized that the views of foreign experts regarding a timetable for development of these aircraft are highly cautious: the appearance of a supersonic STVL aircraft can scarcely be expected within the first five years of the next century even with intensive research efforts.

Design and development of supersonic STVL aircraft require thorough analysis of the specific features of the design layout of existing subsonic aircraft with vectored-thrust engines, placement of powerplants, and trimming of aircraft pitching moments during deflection of thrust-vectoring exhaust nozzles. The first experimental aircraft with vectored-thrust engines were



designed as purely VTOL aircraft. For example, the SC-1, the Mirage IIIV, and VJ101C were not designed for STOL but were used primarily to work on stability and controllability of VTOL aircraft during hovering or in transition conditions of vertical takeoff and landing.

As we know, vertical takeoff is accomplished when the ratio of engine thrust to aircraft force of gravity (at takeoff thrust-to-weight ratio micro) greater than 1. For example, the takeoff thrust-to-weight ratio of the Mirage IIIV combined powerplant is micro-1=1.18 for the lift engine and micro-c=0.35 for the cruise engine, while the VJ101C aircraft has a ratio of 0.419 and 0.837 respectively. This results in a heavy powerplant for these aircraft. For example, the relative weight of an empty aircraft as a percentage of normal takeoff weight is 79 percent for the Mirage IIIV and 71 percent for the VJ101C. These aircraft have a small relative payload weight (fuel and weapons).

The Harrier, for example, was designed with an integrated powerplant, including a Pegasus vectored-thrust engine with tiltable exhaust nozzles. The relative weight of an AV-8B empty as a percentage of standard takeoff weight is 65 percent, approximately the same as aircraft not equipped with a vectored-thrust propulsion system, which employ a normal takeoff roll. For example, the relative weight of a Jaguar S and Alpha Jet empty is 66 percent, and that of the F-15A and F-16A fighters is 65 percent. Aircraft which take off with a normal roll are designed with takeoff capability in an overloaded configuration with maximum takeoff weight substantially exceeding normal. The ratio of maximum to normal takeoff weight is 1.48 for the Alpha Jet, 1.35 for the Jaguar S, 1.34 for the F-15A, and 1.57 for the F-16A. In an overloaded-configuration takeoff the relative weight empty to maximum takeoff weight drops on the average to almost 50 percent. The ratio of payload to maximum takeoff weight shows almost the same increase, while takeoff and landing performance is much worse.

In addition, increased demands are made on quality and size of runways, particularly length. Therefore the AV-8B was designed with the capability to increase takeoff weight by 46 percent above normal. In this configuration the aircraft takes off not vertically but with a short 300-meter takeoff roll. The relative weight of an AV-8B aircraft empty is 44 percent of maximum takeoff weight, just as conventional aircraft taking off with a takeoff roll in the overloaded configuration.

Thus the AV-8B aircraft with vectored-thrust engines is in no way inferior in relative fuel reserves and combat payload to the F-15A, F-16A, Jaguar S and Alpha Jet, which are equipped with conventional powerplants. With a maximum takeoff weight of 13 tons, the AV-8B carries 3.4 tons of fuel and has a 2.27 ton combat payload. If it had been designed only for vertical takeoff, this aircraft would not have such good performance figures. In fact, with a vertical takeoff, the ratio of payload to normal takeoff weight is only 34 percent. Payload weight does not exceed 1 ton, while the internal fuel tanks are not fully topped off.

From this one can draw the conclusion that subsonic aircraft with vectored-thrust engines are designed for combat employment primarily with a short

takeoff roll and a payload ratio running 50-55 percent of maximum takeoff weight. We should note that vertical takeoff is used in rare instances, when tactical basing conditions make it impossible to employ a short takeoff roll, such as when operating from helicopter pads on warships and container ships. For this reason it would be more correct to call Harriers STVL, not VTOL aircraft. Precisely because of these factors the P.1216 and P.106 vectored-thrust aircraft presently on the drawing boards are called STVL aircraft. They will have a vertical takeoff capability, but this capability will be utilized only in rare instances, since this results in a substantial decrease in payload.

Employment of vectored-thrust engines and lift engines to provide STVL capability, as well as vectored-thrust engines to improve maneuver characteristics, involves certain requirements regarding aircraft layout, particularly placement of lift engines and vectored-thrust engines relative to the aircraft's center of gravity. The Pegasus vectored-thrust engine on the Harrier aircraft provides deflection of engine thrust vector  $J$  to angle  $\phi$  from the aircraft's longitudinal axis, variable within a range of zero to 105 degrees (Figure 1). On takeoff roll the vectored-thrust engines are in cruise configuration ( $\phi=0$ ) to obtain maximum acceleration. At the moment of liftoff they deflect to angle  $\phi=20-30$  degrees to produce lift.

Experts note that control surfaces are not effective at low liftoff (descent) speeds during short takeoff or landing and at speeds close to zero during vertical takeoff and landing. Control jets operate on compressed air taken from the engine compressor. This reduces engine thrust. Increase in requirements for trimming pitching moments with control jets results in greater engine thrust losses and increased overall powerplant weight.

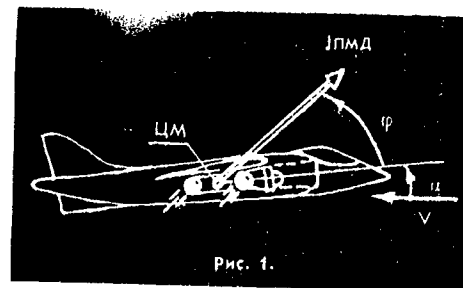


Figure 1.

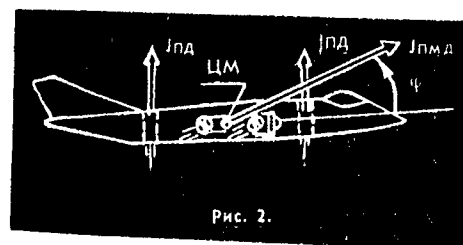


Figure 2.

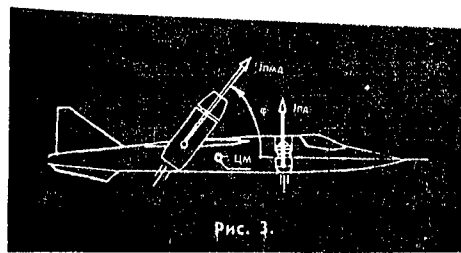


Figure 3.

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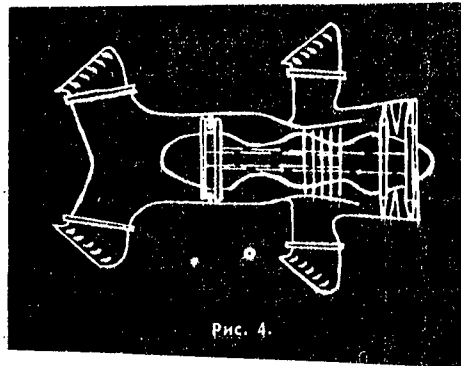


Figure 4.

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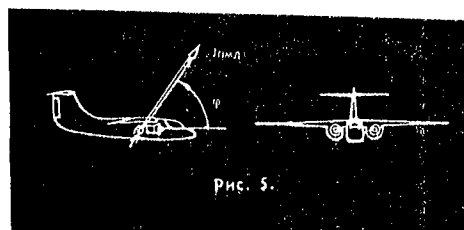


Figure 5.

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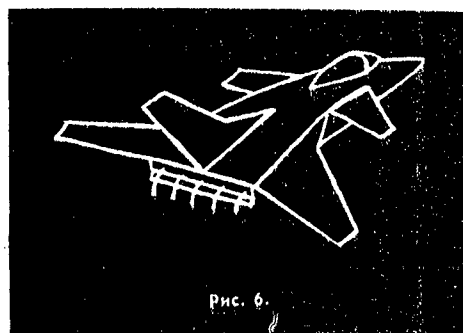


Figure 6.

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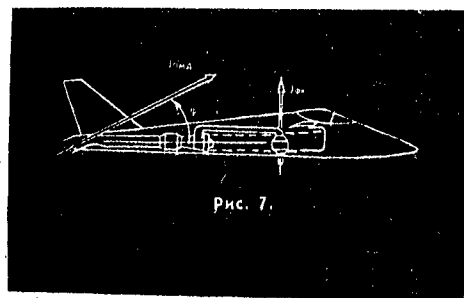


Figure 7.

It has been reported in the foreign press that aircraft with VAK191B (Figure 2) and VJ101C (Figure 3) lift engines and vectored-thrust engines have a lighter powerplant than an aircraft powered only by a vectored-thrust engine, assuming identical aggregate thrust-to-weight ratio on takeoff. This is due to the smaller specific weight of a lift engine than that of a vectored-thrust engine, since lift engines are built with a short service life specifically for use during takeoff and landing. But at the same aircraft liftoff speed, which is determined by aggregate thrust-to-weight ratio on takeoff, the takeoff roll of an aircraft with a combined powerplant (figures 2 and 3) is longer than that of an aircraft with a single integrated powerplant (Figure 1). In fact, on aircraft with a lift engine (figures 2 and 3), only the vectored thrust is used for acceleration during the takeoff roll, while the entire thrust of an aircraft with a single integrated powerplant (Figure 1) is used for acceleration at angle  $\phi=0$ . With the same speed at liftoff, the takeoff roll of an aircraft with a single integrated powerplant,  $L_{rip}$ , is less than the takeoff roll of an aircraft with a combined powerplant,  $L_{rcp}$ . In addition, foreign specialists stress that a VJ101C aircraft with lift engine positioned forward of the center of gravity and vectored-thrust engine aft of the center of gravity requires a longer takeoff roll than the VAK191B, and is particularly inferior to the Harrier. In fact, distance from center of gravity to lift engine and vectored-thrust engine is selected so that during vertical takeoff, at the moment the thrust-vectoring devices deflect to angle  $\phi=90$  degrees (Figure 3), the positive pitching moment from lift engine thrust  $J_{le}$  is equal to vectored-thrust engine negative pitching moment  $J_{vte}$ . With a short takeoff, however, at the moment of liftoff by a VJ101C aircraft, the angle of deflection of its vectored-thrust device is  $\phi=20-30$  degrees, and the positive pitching moment from lift engine thrust exceeds the negative pitching moment from vectored thrust. In order to equalize the pitching moment, lift engine thrust must be reduced during aircraft liftoff, which will lead to increased aircraft speed, a diagram of which is shown in Figure 3.

Thus, as is reported in the foreign press, an aircraft with a single integrated powerplant possesses the best short takeoff performance characteristics.

We shall note that an aircraft with a combined powerplant requires, in case one engine fails, an automatic system to shut down the other engine in order to prevent abrupt rotation and to ensure safe crew ejection. Practical experience indicates that such an aircraft is more difficult to fly. All the

above-enumerated peculiarities of a VTOL aircraft with a combined powerplant resulted in abandonment of work on the VAK191B and VJ101C experimental aircraft.

On the Harrier aircraft there is practically zero distance between the aircraft's center of gravity and engine thrust vector  $J$  at all thrust vectoring device angles  $\phi=0-101$  degrees. This is provided by the Pegasus vectored-thrust engine with four tilting exhausts (Figure 4). In the absence of such an engine, or if a cargo cabin is placed inside the aircraft's fuselage in the area of its center of gravity, such as in the design of a military transport aircraft for the U.S. Navy, the vectored-thrust engines are positioned along the sides of the fuselage (Figure 5). Simpler vectored-thrust engines have a single thrust-vectoring device of a scoop or bucket type, and deflection to angle  $\phi$  from the aircraft's longitudinal axis within a range of  $0$  to  $105$  degrees does not generate a pitching moment from engine thrust.

Foreign experts maintain, for example, that the greater the vectored-thrust engine's thrust-to-weight ratio, the greater the increase in normal load factor with deflection of engine thrust-vectoring devices. In this case it is more advantageous to design aircraft with a single integrated powerplant, as shown in figures 1 and 5. In addition, utilization of lift engine thrust on aircraft with a combined powerplant to improve maneuver performance is complicated due to the limited lift engine service life and the long time it takes them to fire up.

In foreign supersonic aircraft designs, various placement arrangements for vectored-thrust engines are the same in many instances as the layout arrangements of subsonic aircraft. It has been reported in the foreign press, for example, that development and testing of the Pegasus engine with afterburning in the thrust-vectoring nozzles result in a supersonic aircraft with a single integrated powerplant of the Harrier type (Figure 1). The VJ101C experimental aircraft was designed as a supersonic aircraft with the thrust-vectoring pods, containing the engines and afterburner (Figure 3), in cruise configuration. In addition it was emphasized that modern aircraft attain supersonic speeds by cutting in afterburners. Adding an afterburner, however, makes considerably more complex the design of engine thrust-vectoring devices as well as their placement close to the aircraft's center of gravity. It is also believed that with a short takeoff by a supersonic aircraft, tilting the stream of exhaust gases to an angle of  $20-30$  degrees below the aircraft's longitudinal axis at the moment of liftoff will not cause degrading of the runway surface as a consequence of brief contact by the hot exhaust gases. A supersonic STVL aircraft will make a vertical landing with engine exhaust angled downward  $90$  degrees without afterburner, since the aircraft weighs less than during takeoff.

Other materials have also appeared in the press. For example, new engine thrust-vectoring devices are being developed for supersonic aircraft, such as flattened nozzles, which simplify design of a thrust-vectoring device with a boosted engine exhaust stream control system. In addition, when flattened nozzles are placed at the trailing edge of the wing and the engine exhaust is deflected downward by angle  $\phi$  from the aircraft's longitudinal axis,

additional lift is created on the wing, caused by "wing supercirculation effect." This effect is physically similar to the effect of increasing wing lift with a jet flap. Acceptable losses in a flattened nozzle are attained with a width-to-height ratio not exceeding 3:5. The tiltable flattened nozzles run only a small part of the wing span, in comparison with jet flaps, for example, but they deflect a higher kinetic-energy exhaust gas stream.

Placement of such a nozzle at the trailing edge of the wing is possible on an aircraft of a canard-wing design (Figure 6), with the wing positioned aft of the canard wing, with no airframe components in the area of the engine exhaust stream; horizontal stabilizer deflection when trimming pitching moments leads to an increase in aircraft normal load factor.

In a canard design, which offers angle-of-attack static stability, lift trim losses during elevator deflection do not occur. One must bear in mind, however, that an aerodynamic elevator (controllable canard wing) is effective at a fairly high airspeed. Maneuvering with shift in thrust vector at airspeeds below minimum controllable airspeed is out of the question with this type of aircraft. Short takeoff and landing at low liftoff and touchdown speeds are also impossible due to conditions of pitch trim moment.

The design of a supersonic STVL aircraft (Figure 7) as regards distribution of forces from the powerplant relative to the aircraft's center of gravity is similar to that of the aircraft pictured in Figure 3, with its characteristic features: external afterburner thrust is not used to accelerate the aircraft during a short takeoff roll, and using thrust during maneuvering is complicated by the difficulty of firing up the external afterburner and regulating its combined operation with the engine.

In summary, foreign specialists are of the opinion that it is advisable to choose a design layout arrangement for a short takeoff and vertical landing aircraft, and particularly the location of engine exhaust devices relative to the aircraft's center of gravity, ensuring the shortest possible thrust vector arm relative to the aircraft's center of gravity at various angles of vectored thrust. Ignoring this requirement can lead to partial utilization of engine thrust during takeoff, landing and maneuvering, as well as to greater complexity of the aircraft's control system.

While our country, guided by the decisions of the 27th CPSU Congress, is coming forth with specific peace initiatives aimed at preventing a thermonuclear catastrophe, ending the arms race and achieving total worldwide elimination of nuclear and chemical weapons by the beginning of the 21st century, as well as preventing the militarization of space, the U.S. military-industrial complex is continuing to develop new military hardware intended for continuing aggressive U.S. policy "from a position of strength." Analyzing materials published in the foreign press, one readily concludes that many companies are endeavoring to ballyhoo the aircraft and weapons they are developing.

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#### NEW BOOK ON SOVIET SPACE PROGRAM REVIEWED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 6, Jun 86 (signed to press 5 Jun 86) p 43

[Article, published under the heading "Criticism and Bibliography," by Doctor of Technical Sciences Professor A. Brykov, Honored Worker in Science and Technology RSFSR, Lenin Prize recipient: "The USSR Space Program"]

[Text] A book entitled "Kosmonavtika SSSR" [The USSR Space Program] (Moscow, Mashinostroyeniye, Planeta, 1986, 495 pages, illustrations, price 21 rubles 90 kopecks) has recently been published. Practically its entire contents fall within a span of a single generation. Nevertheless the accomplishments of Soviet astronautics and the Soviet space program within such a short historical period are so great that they have exerted enormous influence on world politics, the world economy, development of science, and technological advance.

One notes not without pride when leafing through this attractively-designed book that a group of gifted scientists and engineers, who pioneered the journey into space, developed precisely in our country following the victory of the Great October Revolution. Old ideas on rocket flight and dreams about traveling immense distances were in a harmonious unity with the highly innovative, revolutionary spirit of the victorious political system. The book contains portraits of rocketry buffs and photographs illustrating the history of the Gas Dynamics Laboratory and the Group for the Study of Rocket Propulsion, established in 1932 and headed by S. P. Korolev. The people of this organization built and flight-tested the first Soviet liquid-propellant rockets. Thanks to their labors and studies conducted at the Rocket and Jet Propulsion Scientific Research Institute, rocket projectiles were subsequently developed for our combat aircraft. Japanese forces which invaded the territory of the Mongolian People's Republic, a friend of the Soviet Union, in the vicinity of the Khalkhin-Gol River in 1939, experienced the formidable might of these rockets. The famous Il warplanes were armed with rockets.

The Communist Party and Soviet Government have devoted special attention to the development of space hardware and the exploration of space. This book persuasively demonstrates the scale of projects carried out in this area, innovative projects some of which are unique in world scientific and engineering practice. Multistage boosters and complex unmanned space

vehicles, manned spacecraft and long-lived orbital scientific stations, powerful booster and spacecraft engines and control systems, electronic systems, communications systems, space launch centers, mission control and cosmonaut training centers, space command, control and telemetry systems, search and rescue systems....

The Mashinostroyeniye Publishing House devotes continuous attention to space-related subjects. The secret of this new book's attraction lies not only in the excellent color photographs but also in the engaging simplicity of narration about things which are fairly complicated to present to the general public. Therefore this book, which could be called a cosmic panorama, is of interest both to specialists and to the general reader.

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## SOVIET EARTH RESOURCES IMAGING PROJECTS

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[Article, published under the heading "The Space Program Serving Science and the Economy," by V. Lyndin: "From 'Gyunesh' to 'Kursk'"]

[Text] Two experiments were conducted within the framework of the international project entitled "Study of the Dynamics of Geosystems by Remote Methods": Gyunesh-84 and Kursk. The practical results of Gyunesh-84, which was conducted in 1984 in the Azerbaijan SSR, have been highly praised by specialists. A map of fault lines running along the Caucasus Mountains, on the basis of which one can determine the tectonic structure of rocks to a depth of 80 kilometers, was awarded a Gold Medal of the Exhibit of Achievements of the National Economy of the USSR.

A detailed map of the biological productivity of alpine pastures was also prepared, a study was made of 50,000 hectares of forest in the vicinity of the town of Zakataly, and areas of occurrence of dangerous forestland pests were identified. Zones of erosion processes were established. The farmers of the Grain Sovkhoz imeni Sergo Ordzhonikidze, Azerbaijan's largest, were provided with maps showing the level of the water table and degree of soil moisture saturation in their farm's fields. Investigation of the area of the Adzhinour Salt Lake made it possible to draw up recommendations on reclaiming these barren lands. The anticipated increase in arable land runs as high as 10,000 hectares. One can therefore understand the interest shown by officials of many of the republic's sovkhozes in the "solar" experiment ("gyunesh" means "sun" in Azerbaijani). It was again conducted in 1985 in new test areas.

Here is another interesting fact. On the obtained images scientists detected traces of ancient human economic activity. This is of interest not only to historians but ecologists as well. Today one can use such images to reconstruct the consequences of anthropogenetic effects on nature.

Experts are of the opinion that nature is itself capable of healing inflicted wounds if the degree of damage does not exceed 10 percent. Today we are much more powerful than our ancestors as regards level of knowledge and technological sophistication, but we would do well to take a look at their experience in intelligent land use. Professor V. Vinogradov, director of the

USSR working group on aerospace methods in ecology of the international UNESCO Man and the Biosphere Program, cites the following example.

Back in ancient times the vast territory of the Nogay Steppes served as winter pasture for local pastoral tribes. It was considered off limits in summer, and any violation was severely punished. If tribes were warring against one another, at the onset of winter they would cease military operations and drive their herds to these grazing lands. Each tribe had its own area of steppe.

Attempts to put the Nogay virgin lands to the plow were made in the present century, an undertaking which resulted in dust storms. Poorly-organized grazing of livestock made things even worse. As a result, on satellite photographs we see only sand dunes in place of succulent winter grazing lands.... Steps are now being taken to restore these lands to their former condition, to anchor the sands in place, and to manage utilization and preservation of grazing lands in an orderly manner.

The Kursk-85 experiment, carried out in 1985, was prepared by scientists and specialists from Bulgaria, Hungary, Vietnam, the GDR, Poland, the Soviet Union, and Czechoslovakia. Its aim was to study the state of agricultural crops and devise methods of harvest forecasting with the aid of aerospace technology. The USSR Academy of Sciences Institute of Geography organized and coordinated the experiment. Other participating agencies included scientific establishments of the USSR Ministry of Agriculture and the State Committee for Hydrometeorology and Environmental Control, and the USSR Academy of Sciences Institute of Radio Engineering and Electronics. The Kursk facility, a scientific research field test area of the Institute of Geography, was selected for conduct of the experiment. This decision was made for a reason. First of all, Kursk Oblast is a typical example of intensive agriculture in the Chernozem zone. Secondly, different aspects of activity in the fields of Kursk Oblast have been described in detail by observations extending over many years. Thirdly, methods have been perfected and equipment is in place in this test facility area for combined geographic investigations.

As a rule the principle of multilevel observations is applied in aerospace experiments. Kursk-85 was no exception. Its first "level" consisted of sensors placed directly on the soil. The second level involved the instrumentation of mobile ground facilities. Helicopters and radio-controlled model aircraft flying from 50 to 200 meters above the ground comprised the third level. The fourth level was located higher, at altitudes ranging from 500 to 3,000 meters, utilizing An-2 aircraft. The fifth level was located quite high, at the boundary with the stratosphere, at which An-30 and Tu-134 flying laboratories orbited like silvery birds. And observations were conducted from Earth orbit by Meteor and Kosmos satellites as well as the crew of the Salyut 7 scientific station -- Vladimir Dzhaniybekov and Viktor Savinykh. Incidentally, their cosmonaut colleagues Georgiy Ivanov from Bulgaria, Bertalan Farkas from Hungary, and Vladimir Kovalenok worked at the ground level. Photography of the Earth's surface from the Salyut 7 station was accompanied by satellite imaging. Simultaneously imaging was being conducted from airplanes, helicopters, model aircraft, and ground observation points with new optical and radiophysical equipment designed and built in the countries taking part in the Interkosmos program.

Investigations of the Earth's surface were conducted across a very broad spectrum of frequency bands, since waves of different frequencies carry different information. Visible-light images were supplemented by infrared and microwave images. Imaging at microwave frequencies, for example, provides the capability to estimate soil moisture reserves at various depths with a high degree of accuracy.

The main cycle of observations was handled by Soviet scientists. Specialists from the socialist countries proposed their own variant solutions for accomplishing several practical tasks. GDR-developed equipment, for example, to determine chlorophyll content in leaves was tested, as was a Polish thermal imaging unit which provides capability to measure surface temperature from high altitude.

The aerospace images obtained in various spectral zones make it possible to determine and map the structure of land use, crop density, crop lodging, degree of weed problem, etc, which in the final analysis helps find optimal ways to increase the productivity of agricultural land and organize its efficient utilization.

The Kursk-85 experiment was conducted in three phases, separated from one another by substantial time intervals. The first phase took place in the spring, when field crops were just beginning to sprout (the crew of the Salyut 7 station was not taking part in the observations at that time). The second stage was timed to coincide with the phase of maximum-intensity plant growth, while the third took place just before harvest. In the opinion of specialists, organizing the experiment in this manner makes it possible to assemble a fairly extensive catalogue of the state of agricultural terrains. Observation results were entered into a computer, which processed the data and formed multidimensional models of the test areas. Experiment objectives included assembling the largest possible collection of such models, which in the future would be used as standards for automated interpretation of aerospace sensing data. Academician G. Avsyuk of the USSR Academy of Sciences Institute of Geography characterized these research efforts as follows: "We are presently doing something in the nature of an electromagnetic illustrative dictionary for reading satellite-sensed data. It will be used by thousands of people and dozens of organizations to obtain summary agricultural reports directly from orbit, without ground investigations."

Data from the primary observations were promptly processed at the Kursk facility and disseminated to all participating agencies for further study. Comparing various methods of interpreting the obtained results, scientists will choose the most effective of these methods.

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## DIRT AIRSTRIPS AND AIRCRAFT MAINTENANCE PROBLEMS

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[Article, published under the heading "Our Consultation," by Candidate of Technical Sciences Lt Col B. Kuzevanov: "On a Dirt Airstrip"]

[Text] Aviation personnel sometimes operate on dirt airstrips in the course of combat training activities. This requires of engineers and technician personnel special skills and knowledge of the rules and procedures of aircraft operation and maintenance in these conditions. We shall examine the most typical features which must be considered by aviation engineer service personnel.

First of all one must bear in mind that takeoff from and landing on field airstrips differ in large measure from normal operations at permanent bases, since aircraft movement along a dirt runway is complicated by the forming of ruts, as well as soil erosion resulting from the effect of engine exhaust. Aircraft are also adversely affected by dust and soil particles. When landing gear and other aircraft systems get dirty, their operating condition deteriorates. There is an appreciable increase in engine loading just prior to initiation of the takeoff roll and at liftoff. The condition of the soil plays an enormous role. The presence of water in the soil substantially diminishes soil strength and increases dynamic loads on the aircraft structure.

The degree of soil moisture saturation is estimated by the ratio of moisture present to the maximum possible water content in soil of a given granulometric composition. One should bear in mind that the strength of the upper layers of soil diminishes substantially as it becomes wet. Soil strength also is determined by degree of compaction. The smaller the volume and size of pores in the soil, the less water penetrates into its upper layer. I should also like to note that a dirt runway will be less moisture-saturated and its strength considerably greater if the soil was compacted in the fall.

A dirt airstrip not only impedes aircraft movement but also makes aircraft maintenance more difficult. Particles of dirt, mud, and water can get into an aircraft during takeoff, landing, and taxiing. This can result in damage to engine compressor blades, mud fouling of limit switch mechanisms and other

landing gear components, as well as damage to electrical wiring. Fouling of cooling device intakes affects the operation of onboard equipment. Fuel and oil drains can also become clogged, physical damage can be done to aircraft skin, antennas, and weapons, while optical and radiotransparent elements, cameras and gunsights can experience failure.

Operating aircraft on dirt airstrips sharply increases variable stress loadings on the landing gear during aircraft movement on the ground. As a result of this air gaps form in the landing-gear shock strut joints. Overheating frequently occurs when operating out of dirt airstrips due to increased stress loads on the landing gear, as a result of which wheel bearings experience premature failure. When performing routine maintenance procedures or replacing aircraft, maintenance personnel should devote particular attention to the condition of the bearing races. If cracks or damage in the form of peening are detected on races and balls, the bearings should be replaced. The condition of brakes should also be checked. If soil particles, especially sand, get into the brakes, rapid wear will occur, with scoring of brake disks and drums.

The uneven surface of a dirt airstrip also causes many problems for aviation personnel, as this substantially increases vibration and structural stresses, which is dangerous chiefly as regards the aircraft's structural fatigue strength. This condition broadens the range of aircraft structure vibration frequencies, and during taxiing low-frequency, high-amplitude loads occur, which increase with distance away from the aircraft's center of gravity. This results in abnormal conditions for equipment operation, cracks form, deformations occur, and riveted connections weaken at equipment mounting points. For this reason aviation engineer service personnel should pay particularly close attention during aircraft inspection.

Dust in the air at a dirt airstrip also causes many problems for engineer and technician personnel. The most dangerous are 15-20 micron dust particles. Dust and sand getting into landing-gear joints and aircraft control systems dramatically worsen lubrication. This results in conditions favoring premature wear of parts and scoring. Dust causes intensive deterioration of coatings and, absorbing moisture, promotes the forming of corrosion on parts, especially at difficult-to-inspect locations. Dust getting into exposed-type bearings leads to excessive friction and seizing.

Increasing the interval between aircraft takeoffs, reducing engine operating time on the ground, decreasing intensity of motor vehicle movements on and around the airstrip, regular wetting down of the ground in areas subjected to jet exhaust, and maintaining a sod surface on the airstrip are the principal operational preventive measures directed toward diminishing the effect of dust on aircraft.

When operating aircraft out of a dusty airstrip, it is essential regularly to clean components of fuel, engine lubrication and hydraulic systems of dust and dirt, scrupulously observing all required procedures when fueling and adding fluids. One effective means of combating the adverse effects of dust is to

keep aircraft out of the dust cloud which forms while other aircraft are taxiing and taking off. All these measures will make it possible to maintain the combat efficiency of aircraft at the requisite level.

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